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ANNUAL REPORT

OF THE

HARBOR AND LAND COMMISSIONERS

FOR THE YEAR 1891.

BOSTON :

WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
18 POST OFFICE SQUARE.

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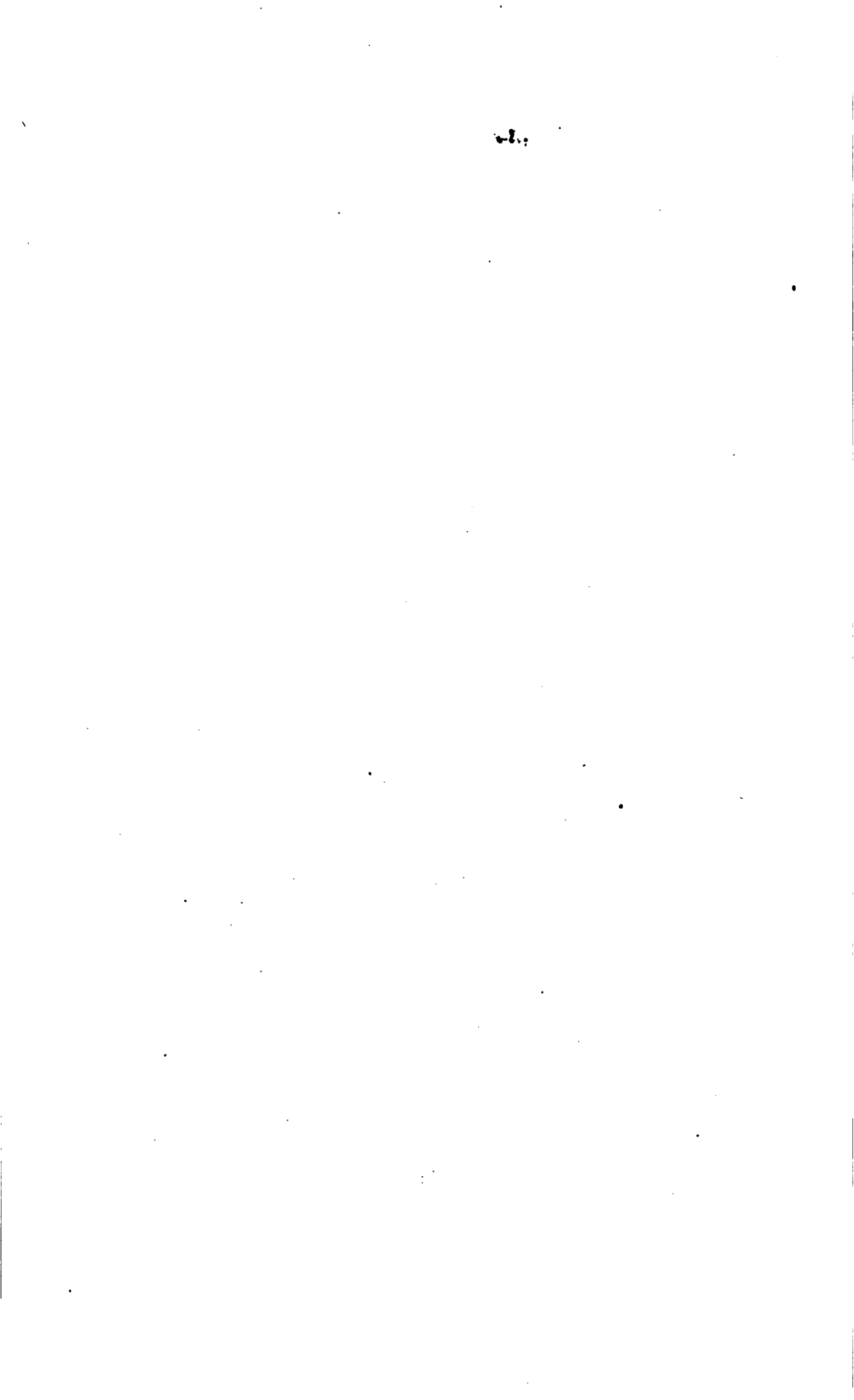
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Commonwealth of Massachusetts.

HARBOR AND LAND COMMISSIONERS' REPORT.

To the Honorable the Senate and the House of Representatives of the Commonwealth of Massachusetts.

The Board of Harbor and Land Commissioners, in accordance with the provisions of law, respectfully submits its Annual Report for the year 1891.

EAST BOSTON BRIDGE.

Chapter 386 of the Acts of 1891, entitled "An Act relating to the building of a bridge connecting the city of Boston proper with East Boston," provides as follows: —

The Board of Harbor and Land Commissioners shall make an investigation into the subject of building a bridge over tide water connecting the city of Boston proper with East Boston; and for such purpose they shall receive and consider such plans for such bridge as the city of Boston or any other party may offer. Said board shall make a full report of their investigations to the next General Court; and shall state in their report whether in their opinion such a bridge can be built without inflicting serious damage upon the wharf property, and materially injuring the commerce of the Commonwealth. And if any plan for said bridge is approved by them, they shall set forth the same in their report.

After public notice in the newspapers, and special notice to persons and corporations known to be actively interested for or against the building of a bridge as proposed, an investigation in compliance with the act was begun in

the Green Room in the State House on October 28, and continued by adjournments from time to time to December 18, 1891. Ten public hearings in all were had. Both sides were ably represented by counsel. Some twenty persons, including prominent citizens of East Boston, appeared to urge their views or to give testimony in favor of a bridge; and more than twice that number, many of them representing large public or private interests, were heard to show reasons against its construction. Others remonstrated by communications in writing. The Boston Marine Society protested by a committee appointed and sent for the purpose, and the Boston Merchants Association by adopting and transmitting resolutions. A large amount of documentary and statistical evidence was also introduced on either side.

A stenographic report was taken by arrangement of the counsel on both sides, and a limited number of copies printed for the convenience of those engaged in the investigation. The printed report makes a volume of over 500 pages, with an appendix of 152 pages, to which are annexed copies of several plans and exhibits introduced at the hearings.

It is obviously impracticable within our present limits to cite or even refer in detail to all the oral and written evidence adduced on the one side and the other. All that can be attempted will be to summarize as fully as may be the facts and considerations which were presented, and which seem to have a material bearing on the questions at issue.

The Board was instructed by the act to "receive and consider such plans for such bridge as the city of Boston or any other party may offer." Only one plan was offered, which will be presently described.

The suggestion of a suspension or elevated bridge, high enough to allow vessels of all sorts to pass under it, was made at the hearings, but was rejected by the advocates of a bridge as out of the question by reason of its cost. It was also objected to such a structure that the lowness of

the shores on either side of the harbor would require the approaches to begin too far inland to suit the convenience of those desiring to use it.

A sub-way or tunnel, though having some obvious advantages for "rapid transit," was objected to in like manner as being dark, damp, dangerous to health, unserviceable for vehicles on runners in times of snow, and undesired by the people of East Boston; and as not being within the scope of the investigation prescribed in the act.

For these reasons, the only plan formally considered was one prepared by the city engineer and offered by the city of Boston.

This plan locates the proposed bridge at the narrowest part of the harbor, just north of the North Ferry, on a line extending a little diagonally across the channel from Battery wharf on the Boston side to Maverick wharf on the East Boston side.

The length of the bridge and approaches is about 2,600 feet from Commercial Street in Boston to Sumner Street in East Boston, about 2,100 feet between abutments, and about 1,450 feet between harbor lines. The width of the bridge proper is 80 feet; of the draw-bridge (which is about 310 feet long), 60 feet.

The draw is a "swing" draw, supported and revolving on a stone pier of about 60 feet diameter placed midway between the harbor lines, with openings of 100 feet on each side for the passage of vessels. From this central pier, a pile pier about 80 feet wide, intended for the protection of the draw and the guidance of vessels through it, extends about 300 feet below and the same distance above the bridge, a little diagonally to the bridge, but parallel with the channel.

The bridge proper is supported on 10 stone piers, 5 on each side of the central draw pier. Six of these piers (3 on each side) come between the harbor lines, the span or distance between the piers being about 180 feet. These 6 bridge piers, with the central draw pier and other structures connected with the draw, occupy and obstruct altogether

about 175 feet of the width of the channel or water-way between the harbor lines.

The height of the under side of the draw above mean high water, is 35 feet. The bridge descends from the draw towards either end on a grade of 3 feet in 100, so that the clear height of the bridge at the harbor lines is reduced to a little less than 20 feet above mean high water.

The length of the corresponding ascent (with 3-foot grade) from either end of the bridge to the draw, is about 1,150 feet, or nearly one-quarter of a mile. For this and perhaps other reasons, it is believed that the bulk of the heavy-team travel would take a ferry in preference to the bridge.

The estimated cost of the bridge is \$2,000,000.

Such being the location and character of the proposed bridge, the question which the Board is directed to answer is "Whether, in its opinion, such a bridge can be built without inflicting serious damage upon the wharf property, and materially injuring the commerce of the Commonwealth."

The question admits of a merely categorical answer; but it is to be presumed that the General Court, in requiring the Board to "make a full report of its investigations," desired such a statement of the grounds of the conclusion arrived at, as should furnish some test of its correctness and of the weight to be attached to it.

The district of East Boston, which it is desired to connect with the city proper by a bridge, is of comparatively recent settlement and growth. The first male child born there, we are told, is still living "a hale and hearty man."

By the census of 1890, East Boston had a population of 36,930, — a little less than one-twelfth of the population of the whole city. The comparative growth in population of the several divisions of Boston from 1885 to 1890, is shown in the following table:—

DISTRICTS.	Population in 1885.	Population in 1890.	Increase.	Percentage of Increase.
Charlestown, . . .	37,673	38,348	675	1.79
South Boston, . . .	61,534	66,791	5,257	8.54
The City proper, . . .	147,138	161,330	14,192	9.65
EAST BOSTON, . . .	31,419	36,930	5,511	17.54
Roxbury,	65,965	78,411	12,446	18.87
Brighton,	8,523	12,032	3,509	41.17
Dorchester,	20,717	29,638	8,921	43.06
West Roxbury,	17,424	24,997	7,573	43.46
City of Boston, . . .	390,393	448,477	58,084	14.88

The valuation of East Boston advanced from \$17,948,800 in 1885 to \$21,193,475 in 1891,—an increase of over 18 per cent.

In view of the above figures, the enterprising citizens of the “Island wards,” dissatisfied as they are with their present rate of progress, will be likely to challenge the conclusion of the Bureau of Statistics of Labor, as stated in its analysis of the census of Boston in 1885, and reiterated in its report on the census of 1890, that East Boston “has practically reached its limit of expansion.”

The reasons alleged in favor of a bridge, are substantially these :—

That East Boston has outgrown the facilities afforded by the ferries ; that the boats are crowded at times, are subject to delays, obstruction by heavy teams, and occasional stoppage by fogs ; that passengers are thereby exposed to discomfort, risk of accident and loss of time ; that the maintenance of the ferries is expensive to the city, and that it would be as cheap or cheaper in the long run to build and maintain a bridge ; that the tolls, although recently reduced one-half, are still an unjust tax ; that East Boston has not been duly cared for, in comparison

with other sections of the city, as regards its means of communication with the centre of business and population ; and that, for these reasons, its growth has been retarded.

It is claimed, conversely : —

That a bridge would stimulate the growth of East Boston ; increase its population ; build up its industries ; attract new enterprises ; enhance market and taxable values ; develop and create a demand for its unoccupied lands and water front ; help to solve the problem of “ rapid transit ” ; and, while thus giving a new life and fresh impulse to East Boston, would benefit the entire city of which it is a part, and be a convenience to the people of Chelsea, Revere, Winthrop, and portions of Essex County.

This is the case as presented by the advocates of a bridge ; and we have endeavored not to understate it. It is not, however, the whole case.

Before considering the expediency of a bridge, it may it may be well to notice the complaints against the present ferry system.

There is some diversity in the testimony of persons residing or doing business in East Boston, in regard to the amount of the annoyance and delay experienced in the use of the ferries. It is not denied, however, that there is some ground of complaint. For about two hours in the morning and evening, and on some public holidays, it is agreed that the ferries are overtasked and crowded, as is not unusual with other lines of suburban travel. There are also occasional detentions by fogs and other stoppages and mishaps, not unlike those which occur on street cars from snow storms, blockades, breakdowns, and other familiar causes.

But it is quite irrelevant to inquire Whether the delays and annoyances of travel on the ferries, as at present equipped, are greater or less than on other suburban lines. The more pertinent question is Why they occur, and whether they can be remedied. Before the inconveniences complained of, whether more or less severe, can be used to justify the building of a bridge across Boston harbor, it must appear that they are inherent in the ferry system, and

admit of no ready or practicable relief. In other words, it must be proved that the capacity of the ferries to serve the public has been exhausted.

Quite the reverse of this appears to be the fact. No better proof can be required than is found in the official Report for 1889 of the Directors of East Boston Ferries to the city council of Boston, to which we were referred, and in which it is said :—

They [the Directors] beg to remind your honorable body that no material changes or additions increasing the facilities of this department, have been made since the city purchased the ferries in 1870, while the passenger travel has increased from 5,000,000 to 10,000,000 annually, and the number of teams in proportion, as may be seen by the detailed statement hereunto annexed.

The rapid increase of travel for the past ten years impresses them with the importance of making ample provision for its continuance, which they feel justified in anticipating, basing their judgment upon the natural facilities which this section of the city affords for manufacture and commerce, and the large tracts of land yet unimproved.

The territorial dimensions of the ferry property is insufficient. The people of the Island wards are familiar with this fact, and have so expressed themselves through their representatives in the City Council, and also in business assemblies.

The improvements asked for will increase the industries and enhance the value of real estate in East Boston, which would consequently become an additional source of revenue to the city, and, in their judgment, in a short time more than compensate it for the proposed outlay.

The present condition of the property, without reference to design or convenience, is fair. There are, however, parts which have been many years in service, in consequence of which they have deteriorated to such an extent that they deem it advisable to have them renewed at once. There are other parts which will need alterations and repairs, all of which should be done in order to ensure safety and confidence.

In view of the above statements, it is not surprising that the Directors felt obliged to recommend the outlay for improvements of even so large a sum as \$500,000, which they apportion as follows :—

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For property on each side of the North Ferry,	\$200,000 00
For two new ferry-boats,	100,000 00
For two new slips,	50,000 00
For two new drops and tanks,	30,000 00
For alterations of present slips,	20,000 00
For new head-house on East Boston side,	30,000 00
For additions to head-house on Boston side,	10,000 00
For dredging,	10,000 00
For contingent expenses,	50,000 00

Adding to the above report the testimony at the hearings, there is good reason to believe that the running of an additional boat during the hours of crowded travel, with improved drops, would alone remove most of the present grounds of complaint.

No time need be spent in showing that well-equipped and well-conducted ferries have also some advantages, as compared with other methods of highway travel.

Whether or not the building of a bridge would be an economical measure for the city of Boston, depends very much on the further question Whether the city would still have to maintain the ferries.

It seems to be generally agreed that the South ferry must be continued, at least until a second bridge shall have been built across the harbor somewhere near its line. The clerk of the Ferry department, an intelligent witness of long experience in connection with the ferries, is of the opinion that, even if a bridge were built, there would still be a demand for two ferries, and that, if not run by the city, private parties could make money by running them.

The fact that the proposed bridge, by reason of its long and difficult grades, would be unsuited to the use of heavily loaded teams, — as already noticed in the description of the bridge, — would of itself practically determine the necessity for the continuance of a ferry near its proposed site.

It was supposed that the Brooklyn suspension bridge would supplant the ferry lines, or some of them, between that city and New York. On the contrary, they are said to have multiplied.

The purpose of East Boston to demand sooner or later an additional bridge or bridges across the harbor, was distinctly announced at the hearings. If, after building the bridge now asked for, Boston must still maintain one or both of the ferries; or if it must satisfy the coming demand for more bridges, so that, as was suggested, East Boston shall be connected with the city proper by bridges across the harbor the same as South Boston across Fort Point channel,—it needs no demonstration that it would be far cheaper and better, not only to renovate the existing ferries, but to make them free.

We have thus far spoken of the proposed bridge as if it raised only ordinary questions of public convenience and municipal economy. We have referred, but only by way of description, to its proposed *location*. It remains to consider the extraordinary interests, both public and private, which such a bridge, in such a location, would necessarily involve.

We are confronted with a proposition *to bridge a harbor*,—not a stream tributary to a harbor, nor a mere arm or inlet of a harbor,—but to bridge across its middle the harbor itself,—and that harbor the chief harbor of Massachusetts and New England, one of the great public harbors of the United States, and of no mean rank among the commercial harbors of the world.

And it is proposed to bridge it with a structure of such character that the steamships and vessels which carry the cargoes of to-day, and which are growing larger year by year, cannot pass under it, but must either run the gantlet of its draw, or abandon their accustomed docks.

It is a novel and startling proposition. There is no precedent for a bridge like this in any commercial harbor of the world. Can Boston or Massachusetts afford to establish such a precedent?

The capacity of a harbor for commerce, other things being equal, is measured by the extent of its improved deep-water frontage. Safe and ample approaches and channels of entrance are essential to a good harbor; but they are of

no value to commerce except as they lead to docks and wharves where merchandise can be unloaded and shipped. Where its wharves and docks are, there, for purposes of commerce, the harbor is.

Throwing out of the account all the improved frontage to be found above the lowest existing bridges on the Charles and Mystic rivers and Chelsea creek, — and it is very far from being insignificant in amount or value, — *one-half* of the harbor of Boston, as it has been developed by more than two centuries of improvement for commercial use, is *above* the line of the proposed bridge. To be exact, there are 57,820 feet of deep-water wharf line below the proposed location, and 57,576 above it before coming to any existing bridge.

The importance of this upper half of the harbor is recognized to the extent that the bridge is to be provided with a draw; but the moment the bridge is built, the interests of those who use the harbor for navigation, and of those who want the bridge for travel, come into conflict; and these interests are so directly opposed, and in this case so large, that they cannot be reconciled.

One of two results must inevitably follow: — *Either the bridge will destroy the navigation, or the navigation will destroy the value of the bridge as a public highway.*

Let us first assume that the interests of commerce will prevail, and the present navigation continue. What, in that case, will be the value of the bridge as a highway for travel?

Those familiar with the harbor know that all vessels passing through the draw of the Charles River bridge, the north and south draws of the Chelsea bridge, and the draw of the Meridian Street bridge, (these being the lowest existing bridges,) must cross the line of the proposed bridge, both in going up the harbor to reach those draws and in coming down the harbor on their return.

According to the Report of the Boston Bridge department for 1890, the whole number of vessels of all kinds passing through the draws in question during that year, was 28,754, classified as in the following table: —

NAMES OF BRIDGES.	VESSELS PASSING THROUGH THEIR DRAWS.				
	Steam- ers.	Sailing Vessels.	Tugs,	All Others.	WHOLE NUMBER.
Charles River, . . .	17	3,668	2,611	1,822	8,118
Chelsea (North draw), .	122	805	4,538	3,487	8,952
Chelsea (South draw), .	7	1,027	3,954	2,355	7,348
Meridian Street, . . .	97	765	2,553	931	4,346
Totals, . . .	243	6,260	13,656	8,595	28,754

The report furnishes no further data for determining how many of the 28,754 vessels could go under the proposed bridge, and how many of them would require the opening of its draw.

To the above number must be added the number of the passages (up and down) of all the steamers, sailing vessels and other craft that go to the wharves or anchorage ground above the site of the proposed bridge, but stop below all the existing bridges, and so do not appear in the above table. There is no official or other complete record of their number; but the evidence tends to show that it largely exceeds the number of those in the table, and that a greater proportion of them would require the opening of the draw.

Rough estimates for a year or day can be based on the above data; but the most exact evidence of the whole number of steamers and vessels of all kinds passing the line of the proposed bridge in 24 hours, was an actual count made October 30 and 31 last, which was produced at the hearings by counsel in favor of the bridge.

The count gave the following footings:—

Whole number of vessels passing October 30,	279
“ “ “ “ “ 31,	317
Number requiring opening of draw October 30,	121
“ “ “ “ “ 31,	128

It is worth remarking that six ocean steamers passed on the first day, and seven on the second day, of the count.

So far as appeared, both days were average days for the time of year. The number of vessels going up and down varies with the season and the weather. It is largest in the summer and early autumn. After a change of wind, coast-wise vessels often come into the harbor in fleets.

Assuming that the count in question gives the fair average for business days with weather admitting of navigation, (say 300 days in the year,) and that the average for the other 65 days would be only one-quarter as large, — the whole number of vessels passing the site of the proposed bridge would be 94,242 a year, 39,373 of which would require the opening of the draw.

Taking, without attempting to cite, all the evidence before us, making all due allowances, and assuming that the draw would have to be opened and closed at short intervals in order to accommodate alternately the travel on the bridge and vessels desiring to pass, — it seems to be safe and within bounds to estimate that, for not less than 300 days in the year, the draw would require to be opened on the average *not less than 100 times a day* for the passage of vessels ready and waiting to go through.

How long on the average would the bridge have to be closed to travel at each opening of the draw? A good deal of testimony was given on this point, with a considerable range of estimates. The lowest figures will suffice.

The estimate by the engineer who planned the bridge, of the time required for getting the gates on the bridge closed, for opening and closing the draw, and for delay in starting and accidents, was 6 minutes. He thought that this time, “if everything worked smoothly,” could be reduced to 3 or 4 minutes. We accept the lower figures. This estimate, however, makes no allowance for the time required for getting the vessel through the draw. We will assume that this will take on the average only 3 or 4 minutes more. This makes 6 to 8 minutes in all for each opening of the draw.

If then, as we have found, the draw must be opened 100 times in a day, the bridge must be closed to travel 600 to 800 minutes in a day, — that is, *from 10 hours to 13½ hours* out of the 24.

According to the count * before referred to, more than eleven-twelfths of this time would have to come out of the 12 hours from 6 A.M. to 6 P.M.

We are aware that many of the experienced pilots and tow-boat captains who testified before us, will consider the above estimates, or some of them, almost absurdly low. They will probably be right in so doing. It would not be difficult to deduce from what seems to be reliable expert testimony, the conclusion that, in order to accommodate navigation, the bridge must be closed to travel, if that were possible, more than 24 hours in a day.

But there is no occasion for nice calculations. It is needless to prove too much. Our estimates will bear even further reduction, and the fact still remain that the bridge would be worthless for public travel.

To avert a conclusion so fatal to the project, it was urged that certain classes of steamers and vessels might adopt the use of "telescoping" smoke-stacks, and masts of such device that they could be lowered or inclined, so as to pass under the bridge without opening the draw. One instance was cited of the use of a stack of this sort on a river passenger boat; and a witness was produced who had seen a mast of this description on one ballast lighter in London 40 years ago, and several within 10 years on small trading craft in the Celebes Islands. Both devices are wholly in disuse by American sea-going vessels of any kind.

It would be humiliating, to say the least, to publish to the world that steamers, barges, lighters, or any other craft that are able to use with entire facility all other civilized ports, could hereafter engage in the commerce of Boston harbor only by lowering their smoke-stacks and dipping their masts.

* The count for both days showed 549 vessels passing from 6 A.M. to 6 P.M., and 47 from 6 P.M. to 6 A.M.

We come now to the important and decisive question, What would be the effect of the bridge, — be its value more or less as a highway, — upon wharf property, and upon the commerce of the Commonwealth?

The term *wharf property*, as used by the General Court in ordering this investigation, and as here used, means something more than so many square feet of land covered by a wharf, and valued as so much per foot on the assessors' lists.

It includes (in this case) the Navy Yard of the United States. It includes all the improvements and outlays that have been made in developing the harbor front above the proposed bridge, and in establishing there deep-water plants for commercial, manufacturing and other business purposes. It includes the extensive and costly terminal facilities which have been provided for the joint use of great connecting lines of land and water transportation. It includes consequentially the value of the trade and business, foreign and domestic, which have been built up by means of these improvements and facilities, and which depend for their successful prosecution on free and uninterrupted access to the sea.

It is impossible to state in exact figures the money value of all the property and interests thus involved. It must be very large, — several times, at least, the entire valuation of East Boston.

The immovable property of the Navy Yard plant, which embraces an area of over 86 acres in extent, and has an excellent frontage of almost a mile in length, has been officially estimated at \$30,000,000.

The Hoosac Tunnel docks, now owned by the Fitchburg Railroad Company, have cost, including elevator and other facilities for export business, over \$2,250,000. Three foreign steamship lines, the Leyland, Allan, and Furness, run regularly to these docks; and it is estimated that one-half of the export business of the port of Boston is there transacted. During the first 10 months of the past year,

139 ocean steamships, 493 schooners, and 13 barks, (645 vessels in all), discharged and loaded at these docks; and the business is increasing year by year.

A great portion of the business of the Fitchburg or Tunnel line is the transportation of merchandise to the seaboard. It is essential to this business that the access to its docks shall be safe and convenient for the connecting steamship lines, or they will cease to come there. Such a result would affect not merely the value of the docks, but impair the value of the entire property of the railroad company, some \$40,000,000 in amount.

The fact that the Commonwealth has spent a good many millions of dollars in building the Hoosac Tunnel line, and now holds \$5,000,000 of its securities, can hardly be urged in this connection. If the State sanctions the bridge, it takes the risk of the consequences, so far at least as its own interests are concerned.

The Mystic docks and terminal grounds, some 100 acres in extent, situated between the north and south channels of the Mystic river estuary, partly below and partly above the Chelsea bridge, have recently been acquired and developed for the uses of the Boston and Maine railroad system. This property has been over 30 years in process of improvement, and represents a very large outlay to its present owners.

An important business has already grown up there under the new and energetic management. The docks below the Chelsea bridge are well adapted to ocean steamers, and are intended to be used for export purposes. An extensive coal and coastwise business, for which the facilities are ample, is rapidly developing at the docks and terminal grounds above the bridge.

Among the scores of other wharves and docks and business plants above the proposed bridge, and below all existing bridges, may be mentioned Battery wharf, Constitution wharf, Fiske's wharf, Gray's wharf, Bartlett's wharf, Comey's wharf, the wharf and works of the Boston Gas Light Company, and the Tudor Company's wharf, on the Boston and Charlestown side; and the wharves and estab-

lishments of the Atlantic Works, Boston Tow Boat Company, East Boston Dry Dock Company, Atlantic Dyewood Company, Boston Dyewood and Chemical Company, C. A. Campbell & Company, Green's wharf and dry dock, Pratt's wharf, and Emery's wharf, on the East Boston and Chelsea side. Others might be named of equal and perhaps greater importance.

Large and important interests in East Boston and Chelsea earnestly oppose a bridge, and the people on that side of the harbor are by no means unanimous in its favor.

No one can, or does, question that a bridge across a navigable water-way, unless of sufficient height and span to allow all vessels to pass freely under it, is, under any and all circumstances, an obstruction to navigation, a damage to the wharf property and water front above it, and an injury to commerce. The extent of the injury varies only in degree, and is to be measured by the magnitude of the interests involved.

It is estimated that the damage to wharf property in general, above the proposed bridge, would be from 25 to 50 per cent. of its present value, depending somewhat on its location relatively to the bridge, and on the class of shipping or the character of the business for which it has been developed. The important wharves just above, as well as those just below, the bridge, would suffer a special injury from their proximity to it. These wharves are now used by the larger class of steamers and vessels, and the bridge, with its long draw piers extending some 300 feet up and down the channel, would make access to their docks difficult and, in some conditions of wind and tide, impracticable.

In measuring the injury to the commerce of the Commonwealth which would result from a bridge such as is now proposed, one important fact must not be lost sight of, — and that is the remarkable increase in the *size* of the steam and sailing vessels by which the commerce of the port of Boston, in common with other commercial ports, is now carried on.

We shall present, on a subsequent page, a table, by which

it will be shown that, while the *number* of vessels engaged in the foreign commerce of this port during the five years 1887–1891, is 20 per cent. less than for the five years 1864–1868, their average *tonnage* is over 139 per cent. greater; in other words, their number is one-fifth less than 23 years ago, and their average tonnage nearly two and one-half times as great.

There is no corresponding record of the number and tonnage of vessels engaged in domestic trade; but the increase in size has not been less striking. The two-masted schooner has given place to the schooner of three and four masts, or to the barge and “whale-back” steamer.

The increase in size is still going on, both in ocean and coastwise vessels.

It is to vessels of large tonnage, and especially to the great ocean steamers, that a draw-bridge is most dangerous and objectionable. The value of ship and cargo not infrequently approaches or exceeds \$1,000,000,—too large a venture to be hazarded by any avoidable risk.

All ships hitherto entering the port of Boston, have had, while passing the site of the proposed bridge, a free and open passage-way of more than a quarter of mile in width. They would now be compelled to pass through a gap of 100 feet in width, in the mid-channel of an already crowded harbor, and where the currents are the swiftest and most variable.

Will the owners of these large ships and costly cargoes expose them to this new peril? The agents and superintendents of the ocean lines, and the steamship commanders, are unanimous in the opinion that they will not.

It may be well to let the captains state the difficulties in their own way. Captain Parry, master of the new steamship *Lancastrian*, of the Leyland line, and the largest of its fleet, says:—

I have run into the Hoosac Tunnel docks as captain of an ocean steamer for ten years, and am familiar with the harbor. The new steamer *Lancastrian*, which I command, has a tonnage of 3,321 tons registered, and is 458 feet long over all, with a beam of 45 feet. Loaded, she draws 26 feet of water on the main, and about 28 feet aft.

No ship-owner or captain would take such a vessel through the draw in the proposed bridge. Under the most favorable circumstances of wind and tide, and with no vessels in the way, it is possible that it might be done safely; but the risk would be so great that nobody would undertake it. The cost of my vessel was £80,000, and the passage of this draw would be a greater peril of the sea than its owners would be willing to expose it to.

In order to pass through this draw with proper steerage-way, the vessel would have to attain a speed of five miles an hour, and it would be impossible to stop her in time to clear the Navy Yard. Going out, the situation would be equally serious. It would be necessary to know not only that the draw was open before the steamer got under headway from the dock, but also that there was nothing in the way either above or below the bridge, as it is impossible for my steamer in the harbor to turn out for the various vessels which it meets in its passage.

When the steamer is loaded with cattle and leaving the dock, it rolls at an angle of thirty degrees. In order to pass through the draw under such circumstances, it would be necessary to use hawsers. No rope would hold the vessel while rolling in this manner, and the distance is too short to have steerage-way to attempt to go through. That is, going out.

As to the suggestion . . . that the vessel, on approaching the bridge, could cast anchor and wait for the draw to be opened, — the effect of this proceeding would be, in certain states of the wind and tide, to cause the vessel to swing around to one shore or the other, and sweep everything in its course, doing great damage to itself and other vessels.

There is no comparison between passing through the proposed draw and entering the Liverpool dock. The former would be vastly more difficult and dangerous. We go to a basin there the whole length of the ship, and out of the tide. Also, a bridge would alter the course of the tide both south and north of the bridge.

Without going into further detail, I should unhesitatingly say that the construction of the proposed bridge would be such an obstruction to commerce that the Leyland line of boats would undoubtedly be withdrawn from the Hoosac Tunnel docks.

The contract by which the Leyland line has agreed for a term of years to dock exclusively at the Hoosac Tunnel docks, contains the *proviso*, that, “if the navigation to said piers or berths, or the use thereof, shall be or become dangerous by the erection of a bridge across Boston harbor,” the agreement may be terminated.

Captain Thompson, master of the *Stockholm City*, of the Furness line, says :—

I am captain of the steamer *Stockholm City*, one of the Furness line, plying between Boston and London, and docking at the Hoosac Tunnel docks, where I have been running for the past six years.

If the proposed bridge is built with a draw opening of one hundred feet, I am sure that no captain or owner of an ocean steamer would take the risk of running through the draw. The approach now to the Hoosac Tunnel docks and the wharves in that vicinity is difficult, and sometimes dangerous, on account of the various tides and currents, and vessels have narrowly escaped disaster while approaching the same. If the bridge were built as proposed, the increased danger from such cause would be so great that I am confident that the owners of the Furness line would withdraw their vessels from the Hoosac Tunnel docks.

No ocean steamer, to my knowledge, has ever been voluntarily subjected to such a peril as the passage of this draw would involve, and the risk is altogether too great to be run.

The statement of Captain Meyerdiercks, master of the *Cremon*, of the Hansa-Johnston line, is to the same effect :—

I am captain of the steamer *Cremon*, of the Hansa-Johnston line, plying between Boston and Antwerp, now docking at the Hoosac Tunnel docks. If the proposed bridge is built, I think it would be a serious obstruction to navigation, and would render the approach to the Hoosac Tunnel docks so difficult and dangerous that no prudent ship-owner would attempt it. In my judgment, it would cause the lines now running to these docks to be abandoned.

The export cargoes of the steamship lines now docking at the Hoosac Tunnel docks, are brought to the seaboard by the Fitchburg road and its connecting railroad lines. Under any existing or probable through arrangement, they would not come by any other railroad line. If the steamships could find other docks below the bridge, the necessary railroad connection would no longer exist.

These great connecting lines of land and water transportation have been established, and are maintained, with great effort and under disadvantages. If Boston had peculiar inducements to offer as compared with other ports,

or if the differential rates were in its favor, it might venture to diminish the facilities which its harbor now affords. If it cares to retain or increase its present commerce, it must be vigilant for their enlargement.

A former Collector* of the port, in speaking of the Maverick bridge scheme of 1868, (to be noticed hereafter,) said with equal truth and pungency, in a letter to one actively engaged against that project :—

I am glad that you are interested in opposing the mad idea of a bridge across the centre of Boston harbor. If it succeeds, notice should be given that no commerce is wanted at this place. I would also suggest two finger-posts, — one pointing toward New York, and one to Portland.

The bridge is, of course, for people to go to and from Boston proper and East Boston ; but no one will wish to go either way, if we give up our harbor and lose our commerce.

The Boston pilots, experienced and clear-headed men, agree in substance with the steamship masters, — that, with favoring wind and tide, by taking time and using every precaution, with the assistance of tugs, and with the way clear below and above the bridge, an ocean steamer might be taken through the draw without accident or injury ; but that it would always be a matter of some difficulty, and, with unfavorable wind or tide, or other adverse circumstance, would be a hazardous undertaking ; and that there would be many days in the year, — on an average one day in five, — when it would not be prudent to attempt it.

The momentum of one of these great ships, when heavily loaded, although moving slowly, is tremendous ; and if it should fail to clear the bridge, or in rolling should strike it, the consequences to the ship, or to the bridge, must be very serious. The danger of such injury is greater to an iron than to a wooden vessel.

If the bridge were built, the Charlestown Navy Yard would undoubtedly be abandoned as one of the great naval depots of the country ; and its value for any maritime

* Hon. Thomas Russell.

use, national or commercial, or for sale, would be greatly diminished.

On the day of one of the public hearings in this investigation, a fresh wind, but not of unusual violence, was blowing from the southwest,—a “side” or “cross” wind for vessels passing the proposed draw. On the morning of that day, the first-class war frigate *Newark* left her dock at the Navy Yard, and dropped anchor in the stream to make her final preparations for sea.

A veteran pilot of 44 years experience in Boston harbor, (and of 43 years residence at East Boston,) gave it as his opinion that, even if the *Newark* had been under “fighting orders,” she could not on that day have been taken out through a 100-foot draw without serious damage; although she might otherwise have gone to sea without delay.

The bridge would prove a serious obstruction not only to ocean and naval steamships, but to the larger coastwise shipping. The officers of the Merchants and Miners Transportation Company, and of the Boston and Philadelphia Steamship Company, testified that they would not dock their steamships above the bridge; and that, if they could not find accommodations below, they should prefer to abandon their business or transfer it to other ports.

If there were no other objections, the unavoidable delays in getting through the draw would be a fatal obstacle to all shipping propelled by steam and requiring dispatch. Loss of time and of regular trips is serious loss of money.

Rapid transit is as desirable and necessary for commerce as for public travel. All vessels having occasion to pass to and fro in the harbor,—lighters, floating elevators, dredgers, the larger tow-boats, all steamers and vessels going to coaling stations, ship-yards, dry docks, or elsewhere, for supplies or repairs, would be subjected by a draw-bridge to constant annoyance, loss of time, and consequent loss of money.

That there would be frequent and serious delays to all kinds of vessels in passing the draw, experience leaves no room to doubt. Such has been and is the fact in the

case of all the existing highway bridges, to say nothing of the railroad bridges, across the rivers and channels tributary to the harbor.

The superintendent of the Boston Tow Boat Company testified from long experience, and without contradiction, as follows :—

We have got a lot of bridges in Boston now, that we can't get through in half an hour's time. Many a time I have come up to these [Congress Street, Charles River, and Warren] bridges, and blown my whistle for them to take off, and asked them to take off, — that is, signalled for them to take off; and I would lie to, and then I would be from three-quarters of an hour to an hour in getting through from the time I got there.

In the struggle between navigation and public travel, the draw-tender is an important factor. He is, and must be, vested with a large discretion. He is a city official; and, however honest and well-meaning, he will feel the stronger pressure brought to bear by the people who travel on the bridge, with whom he comes in immediate contact, and upon whose good-will his position may more or less directly depend.

Navigation, as compared with public travel, always stands the poorer chance. The odds are against it. As navigation loses, public travel becomes more aggressive. Sooner or later we hear the already familiar demand for shutting the draw during portions of the day, and finally for closing the water-way to navigation altogether.

However it might turn out in the present case, and under the most favorable circumstances, the number of vessels, as before shown, would be so great that there must be much waiting and loss of time. After certain stages of wind and weather, if not as an ordinary occurrence, vessels would be likely to collect below or above the bridge beyond the capacity of the draw, and in sufficient numbers to obstruct the harbor and to discommode and endanger each other.

Boston harbor has many natural advantages, which place it on the whole in the first rank; but the capacity of its upper basin for anchorage, is already very much limited.

Above the proposed bridge, and below existing bridges, there is a water area of some 360 acres in extent, much of it having a least depth of 23 feet* at mean low water, which affords the best protected anchorage ground of the upper harbor. By cutting off free access to this anchorage ground, the bridge would seriously diminish the safety and convenience of the harbor for commerce. With its long draw piers, it would also of itself occupy much of the room now available for the movement or anchorage of vessels.

A bridge would add to the burdens of the commerce of the port. Every ton of coal carried above it must pay three cents more freight per ton, — a tax which in the end the consumer must pay. The expense for tug-boat service would be increased; and the loss resulting from inconvenience and delay, as already stated, would be constant and unavoidable. Commerce is sensitive to all such burdens.

The effect of a bridge placed at the neck of the upper harbor, with its 11 solid piers contracting the channel, would be to accelerate the flow of the already swift and variable currents, to increase the scour and lift the material from the bottom, carrying and depositing it where it may be most injurious to the harbor.

The piers would also have a tendency to hold and collect the ice above the bridge, and thus to block the upper harbor to navigation in the winter season.

It is admitted, even by its advocates, that the bridge would work some detriment to wharf property, that steamers going above it might be delayed and put to some expense, and that its effect might be to drive some of them away from the wharves above its proposed site. Its advocates claim, of course, that there would be full compensation in other directions for the injury done.

The able solicitor of the City of Boston, however, looks the issue squarely in the face. He does not hesitate to de-

* The national government has added 30 acres to this deep-water area, by removing the Man-of-War and Mystic shoals, under appropriations by Congress.

clare the opinion that, instead of hurting commerce, it would greatly benefit Boston commercially to build the proposed bridge without any draw in it; and, by thus cutting off all navigation above it, lead to the development of better wharves and docks lower down the harbor.

In support of this somewhat radical suggestion, plans were introduced to show where and how the lower harbor could be developed.

The first plan offered was described by the engineer* who drew it, as "a mere chalk to show the possibilities of development." The second plan bears the marks of a more experienced and skilful hand. When it was first prepared, some ten years ago, it was described by its ingenious framer† as a "preliminary" plan "to illustrate the possibilities of the harbor."

Both plans take in the improvement of the South Boston shore already in progress; but the main and novel feature of each, is an immense scheme for the creation of wharves and docks off the lower East Boston shore, extending by the former plan down to Governor's Island and Apple Island, and by the latter nearly down to those islands, and thence around to Point Shirley in Winthrop.

Professor Whiting testified in regard to the latter plan as follows:—

In this study, I regarded at the outset what we call the inner harbor, as simply a basin. The area in the main basin, which is [according to the plan] about 3,000 feet wide down to Governor's Island and Castle Island, compares about with the London docks, and is a little larger than the present London docks. They have about 1,000 acres, and this has about 1,100 acres. They cost about \$60,000,000 to construct, and the scheme for carrying out this improvement is of equal magnitude.

We do not criticise the plan. On the contrary, it does credit to the large conceptions and constructive genius of its author. The only question now is, Whether it furnishes any reason or excuse for the destruction of one-half of the existing harbor of Boston, or promises any present or

*Nathaniel H. Crafts.

†Prof. Henry L. Whiting.

near relief to commerce after that blow shall have fallen upon it.

A careful estimate shows that it would cost \$30,000,000 to wall in and fill the area of some 1,500 acres which the project includes. To this must be added the cost of the railroad extensions, avenues, and other facilities and improvements necessary to make it available for commercial use.

A scheme of much smaller dimensions, for developing a portion of the East Boston shore, known as the East Haven scheme, was agitated some years ago, but was lost sight of with its ill-starred projector.

Who will undertake this grander project? Who volunteers to pay the cost of the work? Who, judging from past experience, will guarantee that it shall be completed within the next century? Would it not be wise to provide the new harbor before destroying the old?

And if East Boston, as now situated, requires closer connection with the city proper, how will the Apple Island district find adequate means of communication? After commerce shall have re-established itself below the bridge now proposed, what assurance can it have that it will not find itself again and again cut off by still lower bridges for the accommodation of those remoter wards?

And besides, it may be asked, Upon what principle of public policy or public morality is it proposed to destroy or impair the property and interests of one section of the city, and thereby to develop and build up those of another section? It surely will not be attempted or proposed without provision for full and adequate compensation to the former. Who shall pay this compensation? And after all has been done, what will the city or the public have gained in wealth or commercial resources?

We have referred to the above schemes of improvement, because they were urged upon our attention as removing objections to a bridge which it is proposed to build at once. In our judgment, they have no immediate or practical bearing on the subject. However well conceived on paper the plan for creating a new commercial harbor off the

lower East Boston shore, it can be viewed, for any present purpose, only as one of the speculative possibilities of a remote and shadowy future.

The General Court has charged us with the investigation of "the subject of building a bridge over tide water connecting the city of Boston proper with East Boston," as if it were a new question. We have so treated it. It is to be decided upon the facts and conditions of today, and not upon those which existed 20 years ago.

As a matter of history, however, the question has once before been carefully considered and decided.

June 11, 1868, an act (chapter 352) was passed by the legislature of that year, (the objections of the governor to the contrary notwithstanding,) "to incorporate the Maverick Bridge Company." The act authorized that company to build a bridge connecting Boston and East Boston as now proposed.

In less than a month thereafter, July 7, 1868, a joint resolution was adopted by Congress, in the following terms:—

Be it Resolved, etc., That the Secretary of the Navy shall detail two competent and impartial officers of the navy, and the Secretary of War shall detail a competent and impartial officer of the engineer corps, who shall compose a commission, whose duty it shall be to make careful examination of the harbor of Boston, and shall report to Congress, at its next session, in what manner the commerce of said harbor, and the interests of the United States in the navy yard at Charlestown, will be affected by the construction of a bridge over the water between the main-land in the city of Boston and East Boston, in the manner provided in an act of the legislature of the State of Massachusetts, entitled, "An Act to incorporate the Maverick Bridge Company"; and no bridge shall be erected by said company across said water until the assent of Congress* shall be given thereto.

* A publiclaw of the United States, passed at the First Session of the Fifty-first Congress, chapter 907, section 7, approved September 19, 1890, now provides that "it shall not be lawful hereafter to commence the construction of any bridge, bridge-draw, bridge piers and abutments, cause-way or other works, over or in any port, road, roadstead, haven, harbor, navigable river, or navigable waters of the United States, under any act of the legislative assembly of any State, until the location and plan of such bridge or other works have been submitted to and approved by the Secretary of War."

Rear-Admirals Stringham and Bell of the U. S. Navy, and Brigadier-General Simpson, Colonel of Engineers, U. S. Army, were appointed to constitute the commission.

The commission met at the Navy Yard in Charlestown, September 16, 1868, and after sixteen sessions, at most of which "written statements of their reasons for advocating or opposing the proposed bridge" were received from all parties interested and desiring to be heard, made a unanimous report, which is summed up as follows:—

The commission, having now, as it believes, presented all the facts and statements of both parties, and given its own reasoning in the premises, respectfully concludes with the emphatic opinion:—

1st. That the commerce of the harbor of Boston will be very seriously and injuriously affected by the erection of the proposed Maverick bridge, or by any bridge from Boston proper to East Boston,—except a suspension bridge which would allow the passage of vessels of the first class under it at any point.

2d. That the interests of the United States in the navy yard at Charlestown, will be very seriously damaged by such bridge.

3d. That a bridge between the points mentioned should not be authorized.

This report was transmitted to Congress in January, 1869, and referred to a committee. Congress did not give its assent to the building of the bridge. The same year, by chapter 155 of the Acts of 1869, the Massachusetts legislature repealed the Maverick bridge act.

The Maverick bridge was to be located substantially where it is proposed to locate the present bridge.

Its plan differed from the present plan in the following particulars:—

It was to have 3, instead of 11, stone piers, including the draw piers in both cases.

It was to have a uniform height of 30 feet above mean high water, instead of 35 feet at the draw and thence declining to less than 20 feet at the harbor lines.

The draw was to have two openings of $162\frac{1}{2}$ feet, instead of 100 feet, each.

On the whole, the Maverick bridge would have been a much better bridge, both for the harbor and for navigation, than that now proposed.

No higher authority can be found upon the question now before us, than that of the commission which sat upon the Maverick bridge case in 1868; and, unless the effect of its finding can be avoided, it must be accepted as decisive of the present case.

It is, however, sought to avoid it upon the ground that there has been a change in the conditions existing in 1868. The change alleged is in the fact that the population of Boston and East Boston, and of adjacent cities and towns, has largely increased since 1868; and it is argued that "the necessities of this great mass of people demand more and better facilities for getting into and from the city."

This argument has no force unless it is further shown that population has grown faster than commerce. Facilities for suburban travel are not, to say the least, a greater public necessity than facilities for commerce. The fact that Boston is the business and commercial centre, is what makes suburban travel.

We propose to show, on the other hand, that commerce has grown faster than population; and that the demands of suburban travel, instead of being greater, are relatively less, than they were in 1868.

We shall also prove that the commerce of Boston has grown faster than its valuation; and is therefore a more important factor relatively to capital and wealth, than it was in 1868.

The growth in population and valuation of Boston as a whole, and of the district of East Boston, from 1870 to 1890,—the census years nearest the beginning and end of the period under comparison,—is shown in the following table:—

Increase in Population and Valuation of Boston and East Boston from 1870 to 1890.

	1870.	1890.	Percentage of Increase.
Population of Boston,* .	250,526	448,477	79.0
Population of East Boston, .	23,816	36,930	55.1
Valuation of Boston,* .	\$630,355,762	\$822,041,800	30.4
Valuation of East Boston, .	13,296,900	20,458,675	53.9

* Including annexations.

The largest percentage of increase shown in the table is 79 per cent., and the smallest 30.4 per cent.; and the average increase of population and valuation, for both Boston and East Boston, is about 55 per cent.

We are indebted to the courtesy of the present Collector * of the port of Boston, for the following statistics of the foreign commerce of the port for two periods of five years each, ending respectively with the years 1868 and 1891,—the years in which the former and the present bridge projects have been under discussion.

The number and tonnage of vessels entered and cleared during each of these periods (already referred to in another connection on page 21 of this Report), are also shown for convenience in this table.

Foreign Commerce of the Port of Boston—Comparison of Two Periods of Five Years each, ending 1868 and 1891.

	FISCAL YEARS.		Percent- age of Increase.
	1864-1868.	1887-1891.	
Value of imports, . . .	\$179,783,754	\$325,742,962	81.2
Value of exports, . . .	88,066,062	330,559,613	275.4
Totals,	\$267,849,816	\$656,302,575	145.0
Number of vessels entered, .	14,882	11,996	19.4†
Number of vessels cleared, .	15,000	11,914	20.6†
Totals,	29,882	23,910	20.0†
Total tonnage of vessels entered,	3,398,979	6,894,260	102.8
Total tonnage of vessels cleared,	3,251,175	5,839,878	79.6
Totals,	6,650,154	12,734,138	91.5
Average tonnage of vessels entered,	228 tons.	575 tons.	151.6
Average tonnage of vessels cleared,	217 "	490 "	126.2
Totals,	445 tons.	1,065 tons.	139.2

* Hon. A. W. Beard.

† Decrease.

The import trade of Boston, then, has increased 81 per cent. in the last 23 years, and the export trade (a most gratifying exhibit) 275 per cent., — and both together 145 per cent. Population and valuation have grown meantime, as before shown, about 55 per cent. In other words, the *foreign* commerce of Boston has grown nearly *three times* as fast as its population and valuation.

The *domestic* trade and navigation of the port of Boston have increased in a still larger ratio. There is no corresponding official record to show this, but it is proved by established or admitted facts.

While the tonnage of both foreign and domestic vessels is from two to three-fold greater than 23 years ago, the number of vessels engaged in foreign commerce has somewhat diminished, — as the above table shows. But the number of vessels engaged in both kinds of commerce, has largely increased. This must be due to the greater expansion of domestic trade and shipping.

All that the opponents of the Maverick bridge claimed or attempted to prove in 1868, was that 16,486 vessels passed the draws of the upper bridges, and that 32,972 vessels in all passed the site of the proposed bridge, in the course of a year; and the counsel for the bridge protested that those figures were grossly exaggerated.

We have shown by official records that 28,754 vessels passed the upper draws in the year 1890; and the evidence introduced by the counsel for the present bridge, corroborated by all the other evidence in the case, leaves no doubt that from 75,000 to 100,000 vessels each year are now passing its proposed site.

Other facts and statistics, and the testimony of competent witnesses who appeared before us, all tending to the same result, might be cited to strengthen the conclusion; but the above figures alone, taken in connection with the large increase of tonnage, are sufficient to show that the *domestic* trade and shipping of Boston have grown *more than three times* as fast as its population and valuation.

No reason is apparent why the commerce of the port of Boston, both foreign and domestic, should not continue to

grow at an equal or even greater rate of increase. No one had cause to anticipate so large a growth as has just been shown.

A gentleman * thoroughly conversant with the subject, has furnished, at our request, a sketch of the development of the foreign steamship commerce of the port of [†]Boston, which will be found in the appendix † to this Report.

Its period of marked growth appears to have begun about the year 1875. The sailings of foreign steamships have since more than quadrupled, and now average more than one daily. New and important branches of trade have been opened. The rates of freight from Liverpool have been reduced by increase of business and competition to about one-fifth of what they previously were.

The Hoosac Tunnel docks had not been built in 1868, and the steamship lines which now run to them, were unknown to this port. The proposed bridge would cut off from free access to the sea the half of the harbor which has received much of the more recent and best development; and would tend to discourage and drive away from Boston trade and business, both foreign and domestic, which it is highly desirable to retain and foster.

We find, then, that so far as conditions have changed, the interests and claims of commerce are relatively very much greater, and the reasons against a bridge far stronger, than when the Maverick bridge scheme was considered and condemned by the commission of 1868.

The commerce of the port of Boston is rightly described in the act directing the present investigation, as “the commerce of the Commonwealth.” We shall spend no time in trying to prove or illustrate its importance and value to the people of the whole Commonwealth. The legend of our fathers—*By Agriculture we Live, by Commerce we Thrive*—is still an axiom whose truth no one questions.

* Mr. William H. Lincoln, of Brookline, Mass., agent of the Leyland steamship line.

† See Appendix, A.

The harbor and commerce of the port of Boston are not things of a day gone by. Utterances and suggestions to this effect are not unheard, but they are either the groundless croakings of the pessimist, or covers for further designs upon the harbor.

We regret to say it,—but it is too true, that Boston harbor requires to be oftenest and most anxiously defended against the ill-judged measures of those who ought to be, from public spirit or official duty, its most zealous protectors.

The time has not come, and there are as yet no signs of its coming, when Boston harbor, with its tributaries, tidal reservoirs, and water frontage, will have no higher value than for parks and boulevards; or when the treatment and preservation of the harbor will turn on no larger considerations than those of merely local convenience.

The question of a bridge is not a local question. The harbor does not concern the communities alone who dwell on its shores. It does not belong to Boston or East Boston, one or both. It belongs to the Commonwealth. It belongs to the nation that improves and defends it. State and nation alike hold it in trust for the commerce of the world.

The arguments against the Maverick bridge,—and they apply with even greater force to the bridge now proposed,—were summed up in 1868, in one terse and vigorous sentence, by Commodore John Rodgers, then commandant of the Charlestown navy yard:—“*No nation which has the skill to design the Maverick bridge would grant permission to build it.*”

The enterprise and ambition of the people of East Boston are highly commendable, and the growth and prosperity of that section, as of all sections of the State, are much to be desired.

The communities that border on the harbor reap the richest harvests from its commerce, and are most deeply concerned in its protection. A blow aimed at the commerce of Boston could hardly fall with heavier disaster upon any section of the city than upon East Boston.

The building of the proposed bridge, instead of advancing, would, in our judgment, hurt the interests of East Boston; and would prove to be a costly mistake both for it and for the city of which it is a part.

The Brooklyn suspension bridge, under which foreign shipping has no occasion to pass, has a clear height of 135 feet, and a span of 1,595 feet;

The Firth of Forth bridge, Scotland, a clear height of 150 feet, with spans of 1,700 feet;

The Poughkeepsie bridge, across the Hudson, a clear height of 163 feet;

The Washington bridge, across the Harlem River, 125 feet;

The proposed bridge from Blackwell's Island to Long Island, 153 feet;

The proposed bridge across the Hudson from Seventy-first street, New York, to the New Jersey shore, a clear height of 150 feet, with a central span of 2,200 feet, and two side spans of 1,050 feet each.

No bridge should be built from Boston to East Boston which is not high enough to allow all vessels to pass freely under it, and whose span is not equal to the distance between the harbor lines.

In conclusion, we respectfully report to the General Court, That, in our opinion, a bridge connecting East Boston with the city proper, of the character now proposed by the city of Boston, (1) would inflict serious damage upon the wharf property, which is of large amount and value, situate above and adjacent to its proposed site; and (2) would materially injure the commerce of the Commonwealth.

We earnestly recommend that no authority be granted for the building of such a bridge.

No plan for a bridge across the harbor, connecting East Boston with the city proper, which does not call for a clear height of not less than 150 feet above mean high water, and a span of at least the distance between the established harbor lines, should, in our judgment, receive the sanction of the General Court.

SOUTH BOSTON FLATS.

The work of filling and improving the tide-water lands of the Commonwealth at South Boston has been continued without material change in the plan or methods of operation.

The 100-acre lot, all of which is inclosed and filled, and on a portion of which the streets have been graded with gravel, is in substantially the same condition as at the date of the last report. The sewers and other improvements are in good order.

There have been sold from this lot the past year 14,281 square feet of land, lying between Congress and Fargo streets, for \$7,140.50. Several parcels on the water front, 12,500 square feet in all, are leased on such terms as not to interfere with any permanent disposition of the territory which it may be desirable to make hereafter.

During a violent gale in the latter part of March, five schooners and three mud-scows broke loose, and were driven with great force against the bulkhead on the northerly side of the 100-acre lot. The bulkhead was old, and received so much damage that it was thought best to build a new one, parallel with the old, but 20 feet nearer the proposed exterior line of occupation on the harbor front.

A contract* was made May 7, 1891, with Mr. William Miller to build the new bulkhead for the sum of \$5,489. The work was satisfactorily completed and accepted July 3, 1891. The 20-foot space between the old and new bulkheads has been filled with waste material, brought in carts without cost to the Commonwealth, excepting the wages of a man to superintend the dumping.

In the same gale, some powder-boats broke loose and drifted against the new bulkhead on the northerly and easterly sides of the 75-acre lot, damaging portions of it quite badly. A contract† was made April 16, 1891, with Mr.

* See Appendix, B.

† See Appendix, C.

George H. Cavanagh to repair and strengthen this bulk-head, for the sum of \$3,300. The work was satisfactorily completed and accepted July 27, 1891.

Progress of the Work.

The new work of the last year has been mainly expended on the 75-acre lot, which adjoins the 100-acre lot on the east.

Under the contract with the New England Dredging Company, made April 8, 1889, the terms of which have been stated in previous reports, about 135,000 cubic yards of material have been deposited on this lot the last year, equivalent when levelled to about 9 acres, and making in all 27 acres of land filled to grade 13 under this contract.

By its terms, the contract expired with the last year. Some material received by the contractor still requires to be elevated, deposited and graded. About 30,000 cubic yards of material remaining to be dredged under a contract of the United States for work at East Boston, may also be received and handled under the contract before it is finally closed.

An auxiliary contract* was made with the same company June 25, 1891, for filling, with material dredged from the reserved channel, to a higher grade than then filled, a strip 30 feet wide on the 75-acre lot back of the sea-wall on the northerly side of the channel, for a length of about 1,000 feet, the more effectually to stop the flow of water and waste of material through the wall caused by the rise and fall of the tide.

The work was to be completed August 31, 1891. About 7,600 cubic yards of material were deposited in August, in partial execution of the contract, when the contractor required the dredge for other work, and has not since resumed the work called for by the contract. The work done, however, proved sufficient for the purpose desired, and the contract will be closed as it now stands.

* See Appendix, D.

Two comparatively small areas remain to be filled on that portion of the 75-acre lot south of Congress Street. At the same time the Commonwealth is bound by the terms of its agreement made July 1, 1887, and approved June 13, 1888, with the littoral proprietors of the north shore of South Boston, to dredge to its full width that portion of the reserved channel west of L Street, to which the sea-wall now extends.

Proposals were therefore invited by public advertisement in December just past, for dredging the channel and filling the above areas under one contract, providing at the same time for the receiving, elevating and depositing on the 75-acre lot, south or north of Congress Street as may be directed by this Board, such other dredged material as may be offered by the United States or other parties pending the execution of the contract.

The bids were opened on the last day of the year. Some of them were based on new methods of hydraulic dredging, and were the most favorable ever received for such work on the South Boston flats. The contract is expected to be awarded and closed at an early day.

Congress Street.

In view of the importance of Congress Street, as being the most direct and convenient public avenue by which access is had to the Commonwealth's land, and, when finished, by far the shortest and best thoroughfare for business and travel between the centre of the city and South Boston, the work of the last year has been directed to its speedy completion.

Congress Street extends across the territory of the Commonwealth from B Street easterly to the reserved channel, a distance of more than half a mile, with a width of 75 feet. All the material required to complete the filling of the land under and adjacent to the street, to the line of the sea-wall on the reserved channel, was already in place, and was levelled the last spring, and the street made ready for grading to full grade 16 with gravel. It had previously been graded as far easterly as C Street.

A contract* was made May 28, 1891, with Mr. George H. Keyes, the lowest bidder, to complete the gravel grading from C Street to the sea-wall on the north side of the reserved channel, at 64 cents per cubic yard, the work to be finished by December 31, 1891. About 15,000 cubic yards of gravel had been delivered at that date, and about 900 feet in length of the street next the sea-wall had been completed. The rest of the work is well advanced, and is expected to be finished the present month.

Nothing has been done the past year to improve the crossing of Congress Street by the New York & New England railroad tracks. It is still dangerous for teams and travellers, both on account of the trains and by reason of the bad condition of the roadway.

The Cunningham Iron Works Company has begun and is now rapidly building extensive works for the manufacture of boilers and heavy machinery, on land purchased from the Commonwealth at the corner of Congress and B streets. It has now and will have more and more occasion to transport very heavy loads over this crossing in order to reach the city proper. The street ought to be paved and kept in good condition for the use of this and other enterprising corporations who may desire to locate their works on this territory.

A plan has been devised, and streets have been widened with reference to it, for a system of tracks by which all establishments locating on the land now owned by the Commonwealth may be directly connected with steam railroad lines. A license† has been given to the Cunningham Iron Works Company to build and maintain a temporary track across B Street, connecting its works with the tracks of the New York & New England railroad, until other means of connection shall have been provided.

L Street Bridge.

By chapter 388 of the Acts of 1891, the city of Boston was authorized and required to build and maintain a public highway bridge across the reserved channel, connecting

* See Appendix, E.

† See Appendix, F.

Congress Street as laid out and graded by the Commonwealth, with L Street as extended by the city to the southerly line of said channel.

The plans of the bridge, with a draw 40 feet in width, have been approved by us, and the city is about to award the contract for its construction.

Conditioned on the completion of the bridge before the first day of August next, the act provides that the Commonwealth shall reimburse to the city 40 per cent. of its cost. The city desires that the time be extended to the first day of December next. There seem to be good reasons for such extension, and we recommend that it be granted.

This bridge will complete the connection of Boston and South Boston by a broad and direct avenue (Congress Street) across the lands of the Commonwealth. It is to be regarded as an important and hopeful step in promoting the interests of South Boston, the city of Boston and the Commonwealth.

Commonwealth Playground.

By chapter 421 of the Acts of 1891, the city of Boston was authorized to use temporarily a parcel of the Commonwealth's land, bounded by C, D, and Cypher streets and Mount Washington avenue, for a public playground, to be known as "Commonwealth Playground."

This tract was part of a larger one which the city had previously been licensed to use for the same purpose by this Board. The city had inclosed it by a rough fence, and had spread a coating of ashes and some gravel over the surface. The fence has been moved the last season to the boundaries of the smaller area above described, but little else has been done to the playground.

Provision for Continuing the Work.

The balance in the "Commonwealth's Flats Improvement Fund" on the first day of January, 1891, available for carrying on the work, was \$100,694.86; to which there has been added during the year \$2,609.41 income of the fund, \$7,423.31 rents of land and proceeds of land sold, and \$20,000 paid into the fund from the treasury of the Commonwealth under the provisions of chapter 93 of the

Acts of 1889 and chapter 9 of the Acts of 1891; making a total of \$130,727.58 available for the work. Of this sum there has been expended during the year \$61,424.96, leaving an available balance January 1, 1892, of \$69,302.62. In order to provide for the work now in progress and in contemplation, it is estimated that it will be necessary to provide for the payment of \$75,000 into the fund the present year.

HARBOR LINES IN BOSTON HARBOR.

A harbor line board, consisting of General Abbott, Colonels Gillespie and Mansfield, and Major Livermore, Corps of Engineers, U. S. Army, was constituted by order of the Secretary of War in 1888, under section 12 of the river and harbor act of that year, to consider harbor lines in Boston harbor. At the date of the last report, lines had been defined for nearly all of the frontages of the harbor, and were described in that and previous reports.

The harbor line board recommended the last year lines for both sides of Charles River from Market Street bridge up to the Watertown dam; for the northerly side of the reserved channel, and for the main frontage of the Commonwealth's flats east of Slate ledge, at South Boston; and around Castle Island. These several lines were approved by the Secretary of War, January 29, 1891.

Plans showing the approved lines are on file in this office, and descriptions of them are appended * to this report.

The work of the harbor line board has thus covered the entire harbor front from Breed's Island on the north to Moon Island on the south, excepting the South Bay and the frontage of the Navy Yard.

In almost every case where the State had previously established harbor lines, these lines have been adopted without modification by the harbor line board as the lines beyond which no structure of any kind shall extend. In some cases, an inner "*bulkhead line*," beyond which no *solid filling* shall hereafter be permitted, has also been defined. Upon the whole, the harbor line system already established

* See Appendix, G.

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by the laws of the State has been approved and confirmed.

The harbor line board has completed its intended work and has been dissolved.

CHARLES RIVER.

The Harvard bridge was opened to travel the first of September last, and is quite freely used by the public.

By an act of the legislature passed in 1888, the cities of Boston and Cambridge were required to widen the draws in the four highway bridges which cross Charles River next above the Harvard bridge, to 36 feet each. For reasons stated in a previous report, there was some delay in complying with the act. The work was taken in hand by the cities in 1890, and the widening of all the draws has been completed the past year.

The Charles River Embankment Company has dredged from the river basin the last year about 166,000 cubic yards of material, and deposited the same upon its flats west of the Harvard bridge.

The filling of the estates on the Boston side, which was in progress at the date of the last report, has been practically completed, except some surface gravelling.

A large additional area of flats in the basin has been converted by these operations into deep water.

MYSTIC RIVER IMPROVEMENT.

This work involves the filling and improvement of about 90 acres of land and flats lying between the north and south channels of Mystic River. The original grant was to the Mystic River Corporation, in 1855, upon the condition of deepening and improving the river.

The Boston and Maine Railroad has acquired the rights and assumed the obligations of the original grantee. The time for the completion of the work was extended by chapter 240 of the Acts of 1891 to March 1, 1893.

During the last year 250,746 cubic yards of material have been dredged from the north channel of the river above Chelsea bridge, and deposited inside the sea-wall. From one-third to one-half of the required area in the north

channel has been dredged to the prescribed depth. About $85\frac{1}{2}$ acres are now filled to grade 14.5, and the remaining $4\frac{1}{2}$ acres require about 52,000 cubic yards of filling to bring them up to that grade.

In addition to the above, 21,877 cubic yards have been dredged from the south channel above the bridge, and the material carried to the South Boston flats.

The pile platform in front of the sea-wall on the north channel has been completed, 58,630 square feet having been built the last year. On the south channel, the pile platform above the bridge has been partially rebuilt and widened to its full width of 35 feet, 61,118 square feet having been built the past year.

The balance of the filling will probably be completed this year. The dredging in portions of the river has been to a greater depth than was originally contemplated, so that there has been no occasion for digging off the marshes further up the river as provided in the act of 1855. The greater depth was required to adapt the wharf to modern vessels, which have a much larger tonnage and deeper draft than the vessels in use in 1855.

SOUTH BAY.

Early in the last year a topographical survey of the South Bay was made, and a harbor line laid down which was recommended to the General Court for its approval. The harbor line recommended was established by chapter 309 of the Acts of 1891, which also contained provisions intended for the improvement of the bay in sanitary respects as well as for navigation. All previous harbor lines were abolished.

The Roxbury Central Wharf company was licensed June 30, 1891, to fill about 43 acres of flats out to the new harbor line on the southerly side of the bay, the material for filling to grade 12 to be taken from the basin bounded by the harbor line. The work has not yet been commenced.

Applications are also pending for filling large areas of shoal water on the easterly side of the New York & New England railroad.

NEPONSET RIVER.

In 1890, the A. T. Stearns Lumber Company petitioned the Board to assign a location where that company could improve the channel of the Neponset River by dredging, the same to be in compensation for tide water displaced in the construction of the company's wharves at Neponset.

The said company, the Putnam Nail Company, and others petitioned at the same time for the removal by the Commonwealth of certain shoals and deposits in the river.

A survey has been made the past year with a view to obtaining the necessary information and data upon which to act. The survey covers the river from Commercial Point to the lower highway bridge. Soundings have been taken from Commercial Point to the railroad bridge. The shoalest part of the channel lies between the wharves of the Stearns and Putnam companies, and it is this section of the river which the Commonwealth is asked to deepen.

The matter is still under consideration by the Board.

REMOVAL OF WRECKS.

Two wrecks have been removed the past year under the provisions of chapter 260 of the Acts of 1883.

The first was an old hulk which was found floating in Chelsea Creek by the harbor master in 1890, and was towed by him to the South Boston Flats, where it was liable to become a nuisance. After public advertisement, a contract* was made March 30, 1891, with Mr. George A. Lancaster for its removal. The work was satisfactorily done, and his bill was approved June 30, 1891.

The other wreck was the schooner "Aladdin," with cargo of sand, which was sunk near Mt. Washington Avenue bridge in Fort Point channel, having been damaged in passing through the draw of the New York & New England railroad bridge. Bids were invited from various parties, and a contract† was made June 4, 1891, with Mr. George W. Townsend, the lowest bidder, to remove the wreck for the sum of \$500 and the wreckage. The removal was successfully accomplished, and the contractor's bill was approved June 30, 1891.

* See Appendix, H.

† See Appendix, I.

GLOUCESTER, ESSEX AND IPSWICH BOUNDARY LINES.

The Board was directed by chapters 77 and 97 of the Resolves of 1889, to examine and define the boundary lines in tide water between the city of Gloucester and town of Ipswich, and between the towns of Essex and Ipswich, and to report to the General Court.

A full report was made to the last Legislature, giving the results of our investigation and survey, and recommending certain boundary lines in tide water, which were defined in the report, to be established by legislative act.

The city of Gloucester was not satisfied with the tide-water line between that city and the two towns as defined by us, and the whole matter was referred to the present General Court.

The *land* boundary line between Gloucester and Essex runs back about two miles inland from the shore, in what was intended to be a straight course, to an angle or corner between the said city and town. In this line there are four stone bounds, — one at the shore, one at the corner, and two at road-crossings between.

It has been agreed on all sides that the true boundary line in tide water between Gloucester and the two towns, would be the extension of this land line in the same course out to sea; and we so extended it. In finding this course, however, we ran back from the stone bound on the shore only to the next stone bound in the land line, disregarding the other two bounds farther from the shore.

It was claimed by Gloucester that we ought to have run back to the corner bound farthest from the shore; and that, if we had done so, we should have got a different course, and one more favorable to the claim of that city.

In August last our engineer, in company with the city engineer of Gloucester, made a re-survey, in which the position of all four bounds was determined by triangulation. He was also greatly assisted in the work by the courtesy of Mr. Eugene E. Pierce, of the Massachusetts Topographical survey, in pointing out the location of the bounds, and by the use of the signals which he had erected for the town boundary survey now making for the State.

As the result of this re-survey, it was found that the four bounds were *not* in a straight line; and that, if a straight line were drawn from the bound at the corner to the bound on the shore, both of the intermediate bounds would be on the Gloucester side of that line, — the one on the main road between Gloucester and Essex 233.4 feet from it, and the one near the entrance to the Essex poor-farm 58.3 feet from it.

It follows that, if the line joining the two end bounds were adopted as the proper line to be extended out to sea, it would give *less* tide-water area to Gloucester than the line extended and defined by us.

The boundary lines in tide water between the towns, and between the city and the towns, have long been the subject of dispute, and much litigation has resulted. It is more important that the lines be established somewhere, than that either party should get a few feet more or less of tide-water flats. It seems to us a matter of little importance which of the lines is adopted.

We think that the lines indicated in our last report are *substantially* fair and just; and that one or the other of the two lines should be established by the General Court.

FIELD AND OFFICE WORK.

Miscellaneous Surveys.

The work on the South Boston flats has, as usual, occupied the larger part of the time of the engineering force of the office throughout the year.

The following special surveys have also been made and field work done: —

In February and March, two plane-table sheets on a scale of 1000, covering the main portion of the South Bay, were made, and the plans transferred to one large sheet, on which a harbor line was laid down. In June, a third sheet on the same scale was made, which has since been transferred to the large sheet. These three sheets completed the survey, and show the whole of the water area of the bay. The triangulation for the above survey was made

in 1890; but it was found necessary to add three points, and reproduce one old one which had been obliterated. This was done in June last.

In April, examinations of the new Coggeshall Street bridge in New Bedford were made, upon the complaint of the board of public works of that city that the bridge as built did not conform to the plans approved by this Board; and such was found to be the fact.

In July, 23 triangulation stations were established and connected with the triangulation of the U. S. Coast and Geodetic survey, for a survey of the Neponset River from Commercial Point to the lower highway bridge. The last of July and first of August, the topography was plotted on a plane-table sheet on a scale $\frac{1}{2000}$, and soundings were then taken covering the river from Commercial Point to the railroad bridge, and plotted on the plane-table sheet. A section of the river between the wharves of the Putnam Nail and Stearns Lumber companies, has been plotted on a scale of $\frac{1}{1000}$.

In the latter part of August, 11 new stations, including four town bounds, were determined by triangulation in Essex and Gloucester, and plotted on a scale $\frac{1}{4000}$, the same as that of the survey of Essex River made last year.

A re-survey of the beach near the Gurnet in Plymouth was also made in August, and it was found that there had been no material change since the previous surveys.

In September and the first of October, 21 stations were established along the Connecticut River at Springfield, and their positions determined by triangulation from a base measured on the Boston & Albany railroad bridge. Based on these a plane-table sheet was made, showing both banks of the river for about 9,000 feet along and opposite the main business portion of the city of Springfield, and showing also the existing encroachments on the river within those limits.

In November and December, a plane-table survey plotted on a scale $\frac{1}{2000}$ was made of both banks of the Connecticut River at Hadley, for a distance of about 8,000 feet above the protective works which were built by the Commonwealth in 1889 and 1890.

In December, a survey of the Mystic River at West Medford, from the Boston & Lowell railroad bridge to the bridge at the pumping station of the Mystic water works, was made and plotted on a scale of $\frac{1}{500}$.

Licenses Granted during the Year 1891.

The following licenses, one hundred and twenty in number, — the largest number ever granted in a year, — have been granted the last year. The licenses which are required under recent statutes for structures in the Connecticut River and in great ponds, as well as those in tide waters, are included in the list.

Nos.

1307. Petition of the Union Freight Railroad Company for license to dump snow and ice from Constitution wharf into Boston harbor. Granted January 1, 1891.
1308. Petition of the Cambridge Electric Light Company for license to build a wharf, partly solid and partly on piles, on Charles River in the city of Cambridge. Granted January 1, 1891.
1309. Petition of A. R. Eldridge & Company for license to build a wharf by filling solid on Monument River in the town of Bourne. Granted January 1, 1891.
1310. Petition of George E. Nickerson for license to build a dike in Muddy Cove in the towns of Harwich and Chatham. Granted January 1, 1891.
1311. Petition of the city of Boston for license to dump snow and ice into the rivers and tide waters in and around said city. Granted January 8, 1891.
1312. Petition of John Q. Adams and Charles F. Adams, trustees, for license to build a sea-wall and fill solid on Charles River in the city of Boston. Granted January 15, 1891.
1313. Petition of Isaac Pratt, Jr., for license to extend his piers, on piles, at the McKay wharf in Boston harbor at East Boston. Granted January 15, 1891.
1314. Petition of the board of Metropolitan Sewerage Commissioners for approval of plans for building a sewer and siphon across Belle Isle Inlet in the city of Boston and town of Winthrop, as authorized by chapter 439 of the acts of 1889. Granted February 5, 1891.

1315. Petition of the board of Metropolitan Sewerage Commissioners for approval of plans for building a sewer and siphon across Shirley Gut in the city of Boston and town of Winthrop, as authorized by chapter 439 of the acts of 1889. Granted February 5, 1891.
1316. Petition of George D. Emery for license to build a timber dock, pile pier and pile platforms in Boston harbor near the junction of Chelsea Creek and Mystic River in the city of Chelsea. Granted February 5, 1891.
1317. Petition of William H. Burke for license to widen and extend his wharf, partly solid and partly on piles, in Scituate harbor in the town of Scituate. Granted February 12, 1891.
1318. Petition of Colcord Upton for license to build a pile wharf at Baker's Island in Massachusetts Bay in the city of Salem. Granted February 12, 1891.
1319. Petition of the Boston Land Company for license to fill solid on Chelsea Creek at Breed's Island in East Boston. Granted February 19, 1891.
1320. Petition of Albin M. Richards for license to extend his wharf by filling solid on Mystic River in the city of Boston. Granted February 19, 1891.
1321. Petition of the board of Metropolitan Sewerage Commissioners for approval of plans for building a pumping station, sewer and siphon, across Chelsea Creek in the cities of Boston and Chelsea, as authorized by chapter 439 of the acts of 1889. Granted February 19, 1891.
1322. Petition of the board of Metropolitan Sewerage Commissioners for approval of plans for building a portion of section F of a main sewer in Charles River in the town of Watertown, as authorized by chapter 439 of the acts of 1889. Granted February 19, 1891.
1323. Petition of the board of Metropolitan Sewerage Commissioners for approval of plans for building a sewer and siphon across Malden River in the towns of Medford and Everett, as authorized by chapter 439 of the acts of 1889. Granted February 19, 1891.
1324. Petition of F. A. Merriam & Company for license to extend their wharf on piles in Dorchester Bay in the city of Boston. Granted February 26, 1891.
1325. Petition of Orray A. Taft for license to build a pile wharf in Boston harbor at Point Shirley in the town of Winthrop. Granted February 26, 1891.

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1326. Petition of George B. Roberts for license to extend his wharf by filling solid on Charles River in the city of Cambridge. Granted February 26, 1891.
1327. Petition of the town of Winthrop for license to fill solid a portion of Washington Avenue bridge in Crystal Cove in the town of Winthrop. Granted March 12, 1891.
1328. Petition of E. P. Welch and George F. Welch for license to widen and extend their wharf on piles in Scituate harbor in the town of Scituate. Granted March 12, 1891.
1329. Petition of C. A. Boyd for license to extend his wharf by filling solid on Powow River in the town of Amesbury. Granted March 12, 1891.
1330. Petition of the Boston and Maine Railroad for license to replace its wooden bridge by an iron bridge across Parker River in the town of Newbury. Granted March 12, 1891.
1331. Petition of the city of Cambridge for license to widen the passage-way for vessels in Western Avenue bridge and to build a new draw-pier in said bridge on Charles River in the city of Cambridge. Granted March 12, 1891.
1332. Petition of the board of Metropolitan Sewerage Commissioners for approval of plans for building an outfall sewer in Boston harbor at Deer Island, as authorized by chapter 439 of the acts of 1889. Granted March 12, 1891.
1333. Petition of the board of Metropolitan Sewerage Commissioners for approval of plans for building a pumping station, sewer and siphon, across Mystic River in the city of Boston, as authorized by chapter 439 of the acts of 1889. Granted March 12, 1891.
1334. Petition of the heirs of James A. Stetson for license to widen, extend and maintain their wharf on piles in Gloucester harbor in the city of Gloucester. Granted March 25, 1891.
1335. Petition of Frederick Mason for license to build a boat-house on piles on Taunton Great River in the city of Taunton. Granted March 26, 1891.
1336. Petition of the Butchers Slaughtering and Melting Association for license to build a sea-wall and pile platform and to fill solid on Charles River in the city of Boston. Granted April 9, 1891.
1337. Petition of the New England Dredging Company for license to build a pile structure on Charles River in the city of Cambridge. Granted April 9, 1891.

1338. Petition of Henry L. Pierce for license to build a bridge across Neponset River in the city of Boston and town of Milton. Granted April 23, 1891.
1339. Petition of William H. Quiner for license to build a marine railway and extend his wharf on piles in Marblehead harbor in the town of Marblehead. Granted April 23, 1891.
1340. Petition of Augustus S. Messer for license to build a sea-wall and fill solid in Little harbor at Woods Holl in the town of Falmouth. Granted April 23, 1891.
1341. Petition of the Gloucester Gas Light Company for license to extend and maintain its wharf on piles, and to define the limits of its dock, in Gloucester harbor in the city of Gloucester. Granted April 23, 1891.
1342. Petition of Frederick W. Dickinson and others for approval of plans for building a bridge over the channel connecting north and south bays at Osterville in the town of Barnstable, as authorized by chapter 25 of the acts of 1891. Granted May 1, 1891.
1343. Petition of the board of County Commissioners of Barnstable County for license to rebuild and widen the bridge across Bump's River in the town of Barnstable. Granted May 1, 1891.
1344. Petition of the town of Hull for license to fill solid the bridge across the outlet of Marsh Pond in the town of Hull. Granted May 1, 1891.
1345. Petition of Edward F. Linton for license to build a sea-wall and fill solid on Weymouth Fore River in the town of Weymouth. Granted May 7, 1891.
1346. Petition of the board of Metropolitan Sewerage Commissioners for approval of plans for building a portion of section C of a main sewer in a creek flowing into Charles River in the city of Boston, as authorized by chapter 439 of the acts of 1889. Granted May 7, 1891.
1347. Petition of Lewis F. Buchanan and others, trustees, for license to build a pile pier in Nantucket harbor in the town of Nantucket. Granted May 14, 1891.
1348. Petition of Hannah F. Rogers for license to build dikes and flumes and to draw water from Cedar Pond and Pickerel Pond in the town of Wareham. Granted May 14, 1891.
1349. Petition of Rogers Brothers for license to extend their wharf on piles in Boston harbor at South Boston. Granted May 14, 1891.

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1350. Petition of Charles H. Jones for license to fill solid in Chapaquoit harbor in the town of Falmouth. Granted May 25, 1891.
1351. Petition of Franklin King and Charles H. Jones for license to build a breakwater and wharf in Chapaquoit harbor in the town of Falmouth. Granted May 28, 1891.
1352. Petition of Susie E. Trask and Horace W. Woodberry for license to widen their wharf by filling solid in Beverly harbor in the town of Beverly. Granted May 28, 1891.
1353. Petition of William O. Cutter for license to build a pile wharf in Buzzard's Bay at Monument beach in the town of Bourne. Granted May 28, 1891.
1354. Petition of the town of Falmouth for approval of plans for building a bridge across an arm of Chapaquoit harbor in the town of Falmouth, as authorized by chapter 61 of the acts of 1891. Granted May 28, 1891.
1355. Petition of the city of Salem for license to build masonry piers on North River at North Street bridge in the city of Salem. Granted June 4, 1891.
1356. Petition of Augustus J. Richards for license to build a sea-wall and fill solid on Weymouth Fore River in the town of Weymouth. Granted June 11, 1891.
1357. Petition of Augustus Hemenway for license to build a pile wharf in Beverly harbor in the town of Beverly. Granted June 18, 1891.
1358. Petition of the board of Metropolitan Sewerage Commissioners for approval of plans for building a sewer and siphon across Belle Isle Inlet in the city of Boston and town of Winthrop, as authorized by chapter 439 of the acts of 1889. Granted June 18, 1891.
1359. Petition of the Gloucester Electric Company for license to extend its wharf by filling solid in Gloucester harbor in the city of Gloucester. Granted June 22, 1891.
1360. Petition of Peleg McFarlin for license to build a dam and flume and draw water from Cedar Pond in the town of Carver. Granted June 22, 1891.
1361. Petition of the Roxbury Central Wharf for license to fill land and flats and build structures in South Bay in the city of Boston. Granted June 30, 1891.
1362. Petition of Grover Cleveland for license to build and maintain a wharf and float in Buzzard's Bay at Monument Neck in the town of Bourne. Granted July 2, 1891.
1363. Petition of William L. Bradley for license to build a wharf, partly solid and partly on piles, on Weymouth Back River in the town of Hingham. Granted July 2, 1891.

1364. Petition of Silas D. Fish for license to build a pile wharf in Provincetown harbor in the town of Provincetown. Granted July 9, 1891.
1365. Petition of the Boston Land Company for license to build a bulkhead or dike, fill flats and dredge a channel in Boston harbor at East Boston. Granted July 9, 1891.
1366. Petition of the North Packing and Provision Company for license to widen its wharf on piles on Miller's River in the city of Somerville. Granted July 9, 1891.
1367. Petition of Ethan A. Smith and Percy Parker, trustees, for license to build a pile wharf in Tyng's Pond in the town of Tyngsborough. Granted July 9, 1891.
1368. Petition of Ethan A. Smith and Percy Parker, trustees, for license to build a wharf and other structures in Tyng's Pond in the town of Dracut. Granted July 9, 1891.
1369. Petition of the Quincy Yacht Club for license to build a pile wharf, float, and a portion of a wooden building on Weymouth Fore River at Hough's Neck in the city of Quincy. Granted July 16, 1891.
1370. Petition of George G. Kennedy and others for license to fill land and flats and build structures in South Bay in the city of Boston. Granted July 16, 1891.
1371. Petition of the board of Park Commissioners of the city of Boston for approval of plans for building a pile bridge in Boston harbor between South Boston Point and Castle Island, as authorized by chapter 438 of the acts of 1889. Granted July 16, 1891.
1372. Petition of Silas D. Fish for license to build a pile wharf in Provincetown harbor in the town of Provincetown. Granted July 23, 1891.
1373. Petition of Mary G. Lamper and William A. Lamper for license to build a pile wharf and platform in Lynn harbor in the city of Lynn. Granted July 23, 1891.
1374. Petition of Lewis A. Roberts for license to build a stone and timber wharf in Mattapoisett harbor in the town of Mattapoisett. . Granted July 23, 1891.
1375. Petition of the Union Wharf Company for license to drive piles for the support of a building in Boston harbor in the city of Boston. . Granted August 13, 1891.
1376. Petition of the board of County Commissioners of Plymouth County for approval of plans for building a pile bridge across Duxbury harbor in the town of Duxbury, as authorized by chapter 301 of the acts of 1887. Granted August 13, 1891.

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1377. Petition of the Boston and Maine Railroad for license to build a stone culvert on Little River in the town of Newbury. Granted August 13, 1891.
1378. Petition of the Boston and Maine Railroad for license to build a stone culvert on Knight's Creek in the town of Newbury. Granted August 13, 1891.
1379. Petition of the city of Boston for license to build an addition to the draw-pier of the north draw of Chelsea bridge on Mystic River in the cities of Boston and Chelsea. Granted August 27, 1891.
1380. Petition of the Boston, Revere Beach and Lynn Railroad Company for license to replace its single-track bridge on Saugus River in the city of Lynn and town of Revere, by a double-track pile bridge with an iron pivot draw. Granted August 27, 1891.
1381. Petition of the town of Cohasset for the approval of plans for repairing and rebuilding the dam and flood-gates at Gulf Mill in Cohasset harbor in the town of Cohasset, as authorized by chapter 214 of the acts of 1891. Granted September 3, 1891.
1382. Petition of Warren S. Bumpus for license to excavate a canal and draw water from Dunham Pond in the town of Carver. Granted September 3, 1891.
1383. Petition of William F. Stanly for license to build a pumping station on piles, and to draw water from Dunham Pond in the town of Carver. Granted September 3, 1891.
1384. Petition of the board of County Commissioners of Essex County for license to build a pile and timber bridge across Parker River in the town of Newbury. Granted September 3, 1891.
1385. Petition of the Boston and Maine Railroad for license to build a stone culvert on Little River in the town of Newbury. Granted September 10, 1891.
1386. Petition of the Edison Electric Illuminating Company for license to fill solid on Fort Point Channel in Boston harbor. Granted September 17, 1891.
1387. Petition of Edward Perkins for license to fill solid on Merrimack River in the city of Newburyport. Granted September 17, 1891.
1388. Petition of William S. Coffin for license to fill solid on Merrimack River in the city of Newburyport. Granted September 17, 1891.
1389. Petition of Daniel Leach for license to build a pile wharf at Cheever's Point in Manchester harbor. Granted September 17, 1891.

1390. Petition of the town of West Springfield for license to build a sewer outlet on the Connecticut River in the town of West Springfield. Granted September 17, 1891.
1391. Petition of Andrew W. Dodd for license to build a sea-wall and fill solid in Gloucester harbor in the city of Gloucester. Granted September 17, 1891.
1392. Petition of Isaac C. Wyman for license to build a wharf by filling solid in Lynn harbor in the city of Lynn. Granted September 24, 1891.
1393. Petition of John L. Batchelder, trustee, for license to fill solid a portion of his pile wharf on Fort Point Channel in Boston harbor. Granted September 24, 1891.
1394. Petition of H. V. Partelow & Company for license to build a marine railway in Marblehead harbor in the town of Marblehead. Granted September 24, 1891.
1395. Petition of Frank M. Welles and others for license to build dikes and fill solid in creeks flowing into Crystal Cove in the town of Winthrop. Granted October 8, 1891.
1396. Petition of the Boston and Maine Railroad for license to build a stone culvert and fill solid on Malden River in the city of Malden. Granted October 8, 1891.
1397. Petition of the West End Street Railway Company for license to drive piles for the support of a building on Charles River in the city of Cambridge. Granted October 8, 1891.
1398. Petition of the city of Boston for license to rebuild the head-house foundation and a portion of the piers at the north ferry in Boston harbor at East Boston. Granted October 8, 1891.
1399. Petition of the East Boston Dry Dock Company for license to build a marine railway and extend its northerly pier in Boston harbor at East Boston. Granted October 15, 1891.
1400. Petition of Margaret Wade for license to build two pile wharves in Stage harbor and Oyster Pond River in the town of Chatham. Granted October 15, 1891.
1401. Petition of the Old Colony Railroad Company for license to fill solid a portion of its pile bridge on Weir River in the town of Hull. Granted October 15, 1891.
1402. Petition of the Old Colony Railroad Company for license to fill solid a portion of its pile bridge on Weir River in the town of Hingham. Granted October 15, 1891.

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1403. Petition of the Edison Electric Illuminating Company for license to fill solid on Fort Point Channel in Boston harbor. Granted October 22, 1891.
1404. Petition of John L. Batchelder, trustee, for license to fill solid on Fort Point Channel in Boston harbor. Granted October 22, 1891.
1405. Petition of Joseph Young and others for license to build a dike across Frostfish Creek in the town of Chatham. Granted October 22, 1891.
1406. Petition of the city of Boston for approval of plans for building a bridge across the reserved channel in Boston harbor at L Street in South Boston, as authorized by chapter 388 of the acts of 1891. Granted October 29, 1891.
1407. Petition of the Eastern Dredging Company for license to build a sea-wall, bulkhead and pile pier, and to fill solid on Chelsea Creek in East Boston. Granted November 5, 1891.
1408. Petition of the New England Dredging Company for license to build four dolphins in Boston harbor near the reserved channel at South Boston. Granted November 5, 1891.
1409. Petition of Martha A. Sargent for license to erect a spindle and place three moorings in Massachusetts Bay near Brant Rock in the town of Marshfield. Granted November 12, 1891.
1410. Petition of Albert S. Hathaway and George M. Besse for license to build a dike, flume and canal, and to draw water from Five Mile Pond in the town of Plymouth. Granted November 12, 1891.
1411. Petition of Augustus M. Nickerson for license to build a dike; flume and canal, and to draw water from Long Pond in the towns of Plymouth and Wareham. Granted November 12, 1891.
1412. Petition of the Edison Electric Illuminating Company for license to build a pile wharf on Fort Point Channel in Boston harbor. Granted November 19, 1891.
1413. Petition of the Gloucester Electric Company for license to build a pile wharf in Gloucester harbor in the city of Gloucester. Granted November 19, 1891.
1414. Petition of Charles C. Cobleigh, trustee, for license to extend his wharf on piles on Charles River in the city of Boston. Granted November 19, 1891.

1415. Petition of the West End Street Railway Company for license to dump snow and ice from bridges and wharves into tide waters in the cities of Boston, Cambridge and Chelsea, and the town of Medford. Granted November 19, 1891.
1416. Petition of the Union Freight Railroad Company for license to dump snow and ice from Constitution Wharf into Boston harbor. Granted December 3, 1891.
1417. Petition of the West End Street Railway Company for license to extend its wharf on piles on Miller's River in the city of Cambridge. Granted December 3, 1891.
1418. Petition of F. J. C. Swift for license to build a shooting stand in Buzzard's Bay at Gunning Point in the town of Falmouth. Granted December 3, 1891.
1419. Petition of Dexter J. Cutter for license to drive piles for the support of a building on Mill Creek at Commercial Point in the city of Boston. Granted December 10, 1891.
1420. Petition of the Walworth Manufacturing Company for license to extend its wharf by filling solid in Boston harbor near the reserved channel at South Boston. Granted December 10, 1891.
1421. Petition of Dexter J. Cutter for license to extend his wharf on piles on Mill Creek at Commercial Point in the city of Boston. Granted December 10, 1891.
1422. Petition of the city of Boston for license to relocate and extend the fender guard at the north draw of Chelsea bridge on Mystic River in the city of Boston. Granted December 10, 1891.
1423. Petition of the city of Boston for license to widen the wharf, on piles, at the North ferry in Boston harbor at East Boston. Granted December 10, 1891.
1424. Petition of the town of Winthrop for license to fill solid a portion of Washington Avenue bridge in Crystal Cove in the town of Winthrop. Granted December 17, 1891.
1425. Petition of the city of Cambridge for license to build a pile bridge on Broad Canal in the city of Cambridge. Granted December 31, 1891.
1426. Petition of John P. Squire & Company for license to build a pile wharf and well on Miller's River in the city of Cambridge. Granted December 31, 1891.

RECEIPTS FROM GRANTS OF PUBLIC LANDS.

The amount received during the past year for grants of rights and privileges in lands of the Commonwealth, under licenses of this board for filling and for the erection of wharves and other structures in and over tide waters and great ponds, is \$3,206.80. Other like assessments to the amount of \$5,135.40 have been made during the year, for which the money has not yet been paid into the treasury. Payment for such grants was first required by chapter 284 of the acts of 1874, now chapter 19, section 16, of the Public Statutes. Since the passage of that act, the total amount so received and paid into the State treasury has been \$278,101.40.

HARBOR IMPROVEMENTS BY THE UNITED STATES.

The works of the national government for the preservation and improvement of the rivers and harbors on the coast of Massachusetts, have remained under the supervision of the same able and efficient officers of the Corps of Engineers, U. S. Army, who had charge of them at the date of our last Report,—those on the Eastern section of the coast in charge of Lieut. Col. Samuel M. Mansfield, who is stationed at Boston, and those on the Southern section in charge of Maj. William R. Livermore, whose headquarters are at Newport.

To both of these gentlemen, as to their predecessors, this board is indebted for courteous coöperation, and the public for valuable service.

Since the close of the last fiscal year of the United States, ending June 30, 1891, Capt. William H. Bixby, Corps of Engineers, U. S. Army, has, by order of the Chief of Engineers, assumed the charge of the rivers and harbors on the Southern section of the coast.

Improvements on the Eastern Coast of Massachusetts.

At the request of the Board, Colonel Mansfield has kindly furnished the following condensed report of the work done in the rivers and harbors under his charge during the year 1890:—

UNITED STATES ENGINEER OFFICE,
BOSTON, MASS., December 30, 1891.

The Board of Harbor and Land Commissioners of Massachusetts.

GENTLEMEN:—In accordance with your request of this date, I have the honor to furnish the following summary of the work done by the Government during the year in those rivers and harbors of Massachusetts which are under my charge:—

1. *Newburyport Harbor.*

The general project for the improvement of this harbor has not been changed.

The south jetty and the dike closing Plum island basin, are in the same condition as at the date of my last report.

In the north jetty, during the year, 11,445 tons of rubble stone were deposited, under a contract with Mr. J. H. White, and the full section of this jetty is now 2,485 feet long.

A survey was made of the entrance bar during June, 1891, and at that date the least depth on the bar in a channel at least 300 feet wide, was 12 feet.

2. *Harbor of Refuge, Sandy Bay, Rockport.*

During the year 120,573 tons of rubble stone were deposited in the breakwater, under a contract with the Rockport and Pigeon Hill granite companies, and its sub-structure is now essentially completed between cross ranges 140 and 4,700.

3. *Gloucester Harbor.*

No change has been made in the project for the improvement of this harbor.

During the year 47,298 cubic yards were dredged from Harbor Cove and the main harbor, under a contract with the Bay State Dredging Company.

The channels in Harbor Cove are now each 140 feet wide and 10 feet deep at mean low water, and the main harbor has been improved as projected from the entrance near Fort Point to the steamboat wharf; and 15 feet at mean low water can now be carried thus far.

4. *Manchester Harbor.*

No change has been made in the project for the improvement of this harbor.

During the year 22,052 cubic yards were dredged from the harbor, under a contract with Messrs. Hamilton & Sawyer, and at the date of this report 4 feet at mean low water can be carried to the railroad bridge in a channel 40 feet wide.

5. Salem Harbor.

Operations in this harbor were in progress during the year under a contract with Mr. Augustus R. Wright. At the date of this report, 8 feet at mean low water can be carried to near the head of Derby wharf, in a channel 70 feet wide; thence, to the head of navigation in South River, the proposed improvement has been completed. The improved channel is 6 feet deep, 50 feet wide.

A small ledge was uncovered by the dredging near Derby Wharf light, and it is proposed to remove this ledge with the funds now available for this harbor.

6. Lynn Harbor.

During the year 44,819 cubic yards were dredged from the anchorage basin near the city wharves, thus completing it as proposed.

A survey of the channel through the outer bar, which was dredged in 1885, was made during the year, and it showed that the channel had retained its full depth and width as originally dredged; and therefore the training wall which is projected to aid in keeping this channel open, has not yet been proved to be necessary.

7. Winthrop Harbor.

A channel 35 feet wide, 3 feet deep at mean low water, was dredged from deep water to opposite Rice's wharf, under a contract with Boynton Bros., who removed 20,060 cubic yards in effecting this improvement.

8. Boston Harbor.

Repairs were made to the sea-wall at Great Brewster island; the sea-wall at Gallop's island was extended 345 feet to the southwest; and the rip-rap protecting the south shore of Long island was extended to the west about 250 feet.

The main ship channel at the western end of Brewster Spit was enlarged to its full dimensions, 625 feet wide, 23 feet deep at mean low water, by the removal of 28,510 cubic yards of gravel, under a contract with Mr. Augustus R. Wright.

The channel between Nix's Mate and Long island was enlarged and deepened, under a contract with the New England Dredging Company. During the year 60,000 cubic yards were removed from this channel, and, at the date of this report, it is 250 feet wide, 15 feet deep at mean low water.

The main ship channel was extended from near the Grand Junction wharves to Jeffrey's Point, under a contract with Mr. Augustus R. Wright. During the year 80,000 cubic yards were removed under this contract, and this part of the channel is now 200 feet wide, 18 feet deep, opposite Grand Junction wharf, and 15 feet deep opposite Jeffrey's Point.

Proposals have been invited to widen the main ship channel at the Upper Middle, so far as can be effected by the expenditure of \$40,000; and this work will be done early in the coming year.

No progress has been made in the improvement of the upper Charles River, for which funds were provided by the last river and harbor bill, for the reason that the terms of the act, which require alterations in the bridges crossing this part of the river, have not been complied with.

The Nantasket beach channel was widened so that it is nowhere less than 150 feet wide, $9\frac{1}{2}$ feet deep at mean low water, except over a small ledge uncovered by the dredging near the steamboat wharf.

9. *Hingham Harbor.*

The improved channel in this harbor is now at least 100 feet wide, and 10 feet deep, at mean low water. 20,400 cubic yards were removed under a contract with Mr. Augustus R. Wright, and the project for its improvement has been completed, except the removal of a mid-channel ledge near Chandler's island.

10. *Scituate Harbor.*

The channel connecting the anchorage basin with the town wharves was widened to 100 feet, and deepened to 3 feet, at mean low water, under a contract with Mr. Augustus R. Wright. 30,000 cubic yards were dredged.

11. *Plymouth Harbor.*

The anchorage basin was completed, and the improved channel widened to 130 feet, under a contract with the National Dredging Company. 18,594 cubic yards were dredged, and the project for the improvement is essentially completed.

Repairs and extensions were made to the bulkheads protecting Long Beach.

12. *Wellfleet Harbor.*

No operations were in progress in this harbor during the year, as the expenditure of the funds available for it would not produce any appreciable benefit to navigation and commerce.

13. Provincetown Harbor.

The breakwater protecting the east end of Long Point was extended 200 feet to the northward, to more fully protect this part of the beach.

A bulkhead 2,000 feet long was built west of Wood End light, to strengthen this weak part of Long Point.

14. Chatham Harbor.

A channel 100 feet wide and 6 feet deep at mean low water, was dredged through the middle and inner bars, under a contract with Mr. Charles W. Anthony. 8,714 cubic yards were removed, and at least 5 feet draft at mean low water can now be carried over the outer bar and into the harbor.

15. Merrimack River.

No work has been done during the year.

The funds available are applicable only to Mitchell's Falls, and no benefit to navigation would result from their expenditure.

16. Powow River.

The funds available can only be expended after a draw has been built in the bridge crossing the river, and as yet notice has not been received at this office that such has been constructed.

17. Ipswich River.

No work has been done during the year, as the funds available will not complete the project, and its partial completion would result in no benefit to navigation.

18. Weymouth River.

Under a contract with Mr. Augustus R. Wright, 23,974 cubic yards were dredged from this river, resulting in making a channel 6 feet deep at mean low water, 40 feet wide, to Braintree bridge, and 25 feet wide above the bridge to the head of navigation.

Very respectfully,

S. M. MANSFIELD,
Lieut. Col. of Engineers.

Improvements on the Southern Coast of Massachusetts.

The Board is indebted to the courtesy of Captain Bixby for a copy of the official report of the work done under his predecessor in the rivers and harbors now under his charge, during the fiscal year ending June 30, 1891, from which the following facts are taken:—

1. Hyannis Harbor.

The improvement consists in enlarging by dredging the 15½-foot anchorage ground protected by the breakwater. During the last fiscal year 22,100 cubic yards were dredged, and about 4 acres added to the 15½-foot area.

The balance available July 1, 1891, \$2,015.00, will be applied to the continuance of this work.

2. Nantucket Harbor.

The approved project is the construction of jetties of rip-rap stone projecting from either side of the entrance to the harbor.

Congress appropriated \$25,000 for this improvement in 1890, but owing to the failure to make satisfactory contracts, work did not begin until a few days before the close of the fiscal year, when 300 tons of stone were being delivered daily by hired labor.

Balance available for the work July 1, 1891, \$14,615.00.

3. Edgartown Harbor.

It is proposed to excavate the middle ground of the inner harbor to a depth of 10 feet at mean low water.

No work was done during the last fiscal year. No bids had been received for contract work, and it was proposed to employ hired labor.

Balance available July 1, 1891, \$1,754.

4. Vineyard Haven Harbor.

The plan of improvement contemplates the protection of the chops from the action of the storm waves, by the construction of jetties and other works along the shore.

The last fiscal year a stone jetty was extended 1,150 feet on the East chop, and a longitudinal wall 80 feet long was built on the West chop. 1,064 tons of stone were placed in the work. It is proposed to continue the work, mainly at the East chop.

Balance available July 1, 1891, \$6,076.

5. *Wareham Harbor.*

The approved project provides for the improvement of the channel and the building up of Long Beach. No work was done the last fiscal year.

Amount available July 1, 1891, \$2,493.93.

6. *New Bedford Harbor.*

The plan of improvement contemplates the excavation of a channel of approach to the wharves at New Bedford, 18 feet deep at mean low water. No work was done the last fiscal year.

Balance available July 1, 1891, \$7,031.67.

7. *Westport Harbor.*

The improvement consists in the construction of jetties at the end of Horse Neck Point to prevent its wearing away, and dredging on the Lion Tongue shoal. No work was done the last fiscal year.

Balance unexpended July 1, 1891, \$977.04.

8. *Taunton River.*

The approved project, which has been nearly completed, consists in the widening and deepening of the channel, and the removal of ledges and bowlders from its bottom and sides.

Dredging was begun just before the close of the last fiscal year, and the first reach and a portion of the second reach above Berkley bridge, were completed.

Balance available July 1, 1891, \$2,748.50.

PROTECTION OF ISLANDS IN BOSTON HARBOR.

The importance of preventing the further wasting of the islands and headlands in Boston harbor from the action of winds and waves and other causes, is well understood. The removal from them of gravel and other material for sale or use elsewhere, needs watchful oversight. The only statute on the subject was passed in 1856, before this Board was established. It is recommended that its powers and duties in respect to Boston harbor be made similar to those which have been provided in the case of other harbors and beaches of less importance.

BUOYS FOR YACHTS AND SMALL BOATS.

The Board was directed by chapter 105 of the Resolves of 1891 "to make an investigation and report to the next General Court such plan or plans as seem to them feasible for marking dangerous rocks and bars in the harbors of the Commonwealth in such a way as to secure greater safety to yachts and small boats;" and to "state particularly in their report the expense of carrying out any plans recommended by them."

We have undertaken and made some progress in this investigation. The resolve was passed late in the session, and our purpose to avail ourselves of the information and suggestions of yachtsmen and others interested at public hearings later in the year, has been defeated by the lengthy investigation of the subject of the East Boston bridge, and other somewhat unusual demands upon our time.

There are 42 harbors within the limits of the State in which the national government maintains aids to navigation.

In order to ascertain the number and location of rocks and bars in these harbors which are considered dangerous to yachts and small boats, and which are not marked, interviews have been had with yachtsmen and others familiar with the principal harbors, and numerous places have been visited.

In nine of these harbors 56 places have been suggested as requiring buoys or marks, including 27 places in Boston harbor. In five other harbors, no places have been suggested. In Marblehead harbor, for instance, though much frequented by yachts, the water is deep, and it is said that the rocks and dangerous places are already marked by the national government.

Some attention has also been given to the manner of marking dangerous rocks and bars according to location and depth of water. A buoy which would stand the year round in a channel whose currents keep it free from ice, would be torn away in the shoaler waters of a bay which freezes over in the winter; and the buoy in the latter case must be of such character that it can be conveniently taken up before cold weather and replaced in the spring.

The United States has a system established by public statute for coloring and numbering buoys, so that each has its definite and well-understood meaning. How far it would be necessary to have a uniform system for buoys and marks such as are proposed, and whether that system should be like or quite unlike the national system, may also require consideration.

The approximate cost of 50 spar buoys not exceeding 30 feet in length, as per specifications of the United States Light House Board, including the setting of the same if set in Boston harbor, is estimated at \$2,000. The cost of other buoys and marks cannot be estimated until their character is settled upon.

What has been said suggests rather than answers some of the questions to which this interesting subject gives rise, and makes it apparent that more time is required for its proper investigation. It is the purpose of the Board to continue such investigation and to make further report to the next General Court.

CONNECTICUT RIVER.

The "general care and supervision of the Connecticut River within the confines of this Commonwealth, and of the banks thereof, and of all structures therein," were committed to this Board by chapter 344 of the Acts of 1885. Its attention, and the time of its engineering force, are occupied more and more year by year with the duties and work imposed by this statute.

River Bank at Springfield.

Mention was made in our last report of injurious encroachments on the river along its bank in the city of Springfield. Notice was also received from the city the past year of its desire to extend sewer outlets into the river, with the request that the Board would prescribe the limit of extension and manner of construction.

Partly with reference to this application, and partly with a view to obtaining a record of the present position and con-

dition of the river bank, and also the data for establishing a “harbor” or limit line beyond which no structure or filling shall hereafter be allowed, the survey and plans described on a preceding page of this report, covering the main frontage of the city and the opposite bank for a distance of nearly a mile and three-quarters, have been made the past year.

River Bank at Hadley.

The selectmen of Hadley called our attention the last autumn to the rapid wearing and caving of the river bank in that town along the North Hadley road, so that another year the road would probably have to be re-located farther back from the river. They also expressed the fear that the river might in course of time work in from above back of the protective works built a few years since under a grant of the Legislature, and again endanger the village of Hadley.

The survey mentioned on a preceding page was accordingly made with a view to obtaining a record of the present position of the river bank, and thereby determining by comparison with future surveys the progress of the invasion of the river; and, if found necessary, checking it in season to prevent injury to the protective works and danger to the village.

Protective Works at West Springfield.

Provision was made by chapter 90 of the Resolves of the last year, for the expenditure of \$5,000 under the direction of this Board for protective works “to prevent the further inroads of the Connecticut River upon the easterly side of the town of West Springfield and the destruction of property in said town.”

After preliminary examinations and surveys, the work was taken in hand, and has been executed on substantially the same plan and by the same methods as were adopted at Hadley with, so far as now appears, entire success.

The work was done under the immediate supervision of Messrs. E. C. and E. E. Davis, of Northampton, civil

engineers, who also superintended the construction of the protective works at Hadley under our direction. They make the following report : —

To the Board of Harbor and Land Commissioners of Massachusetts.

GENTLEMEN : — We have the honor to submit the following report and summary of the work done under our supervision for the protection of the town of West Springfield against the further encroachments of the Connecticut River, under the provisions of chapter 90 of the Resolves of 1891.

Preliminary surveys for the proposed work were made in June last ; and a plan of that part of the river and its banks lying between the Boston & Albany railroad bridge on the north and the old toll bridge on the south, together with profiles of the bed of the river on its cross sections, was submitted to your Board for consideration, with recommendations for the proposed work.

These profiles showed that the channel or thread of the river ran diagonally across its bed in a south-easterly direction from the westerly abutment of the railroad bridge to the easterly end of the old toll bridge below.

The greatest encroachment of the river on the West Springfield side was found to be immediately below the southerly line of the location of the Boston & Albany railroad. The scouring and receding of the bank had there reached the foot of the dike which had been built along the bank of the river for the protection of public highways and private property, endangering the permanency of that structure, as well as that of others on the bank below.

The method adopted for treating this reach of the river bank in order to prevent further encroachments upon the dike, was similar in kind to the work done under your direction on the river bank in the town of Hadley, in the years 1889 and 1890 ; but the construction was somewhat heavier, with overlapping rip-rap work instead of rubble above the low water line and up the slope to the foot of the dike.

The setting of willows on the slope above the low water line, as was done on the Hadley bank, has been omitted here, the river bank at this place being used largely as a boat landing and also for hauling ice from the river to the ice houses abutting on the dike.

Proposals for furnishing the stone for the work were invited by public advertisement, and the contract was awarded to William P. Latham, of Northampton, at the price of two dollars and ninety

cents (\$2.90) per cubic yard, he being the lowest bidder. The amount of stone delivered by him was 903 cubic yards, under substantially the same specifications as for the Hadley work before referred to.

All other parts of the work have been done by the day under our immediate supervision. The brush and poles for the mats were procured near the mouth of the Agawam River, about three-fourths of a mile below the work, and were brought up on scows.

The number of square yards of mats laid, with the overlying rip-rap work, is 3,570, extending 205 feet in length on the river front at low water, with the down-stream end of the submerged part of the work finished at the angle with the river front shown on the plan.

The foot or outer end of the mats rests on a bar of hard gravel, well adapted to resist the tendency of the current to undermine the work.

The three scows used at this place were the same as those used at Hadley. Upon the completion of the work they were sold to the Springfield Canoe Club, with the poles, lumber, tools, etc., for the sum of one hundred and twenty-five dollars (\$125.00).

The work we consider an ample protection against further encroachments of the river at this place.

We recommend that the selectmen of the town of West Springfield be authorized to have the general oversight and control of the work, to the extent of preventing any disturbance of it by artificial structures built in or upon it and tending to impair its stability.

All bills incurred by us have been paid, and we know of no unsettled claims against the State having their origin in any action of ours in the execution of this work.

The total amount of the expenditures incurred under our direction, of which we have furnished you from time to time detailed statements with vouchers, has been \$4,877.89. Deducting the sum of \$125.00 received from the sale of the scows, etc., as above stated, the net cost of the work of construction has been \$4,752.89.

Respectfully submitted,

E. C. DAVIS,

E. E. DAVIS,

NORTHAMPTON, MASS., November 5, 1891.

Engineers.

It is due to the Messrs. Davis to say that this work, as well as that at Hadley, has been conducted by them with

skill, good judgment and economy, with careful attention to our directions, and to our entire satisfaction. We also take pleasure in stating that in both cases the work has been thoroughly done at a cost less than the appropriation by the General Court.

The foregoing Report is respectfully submitted.

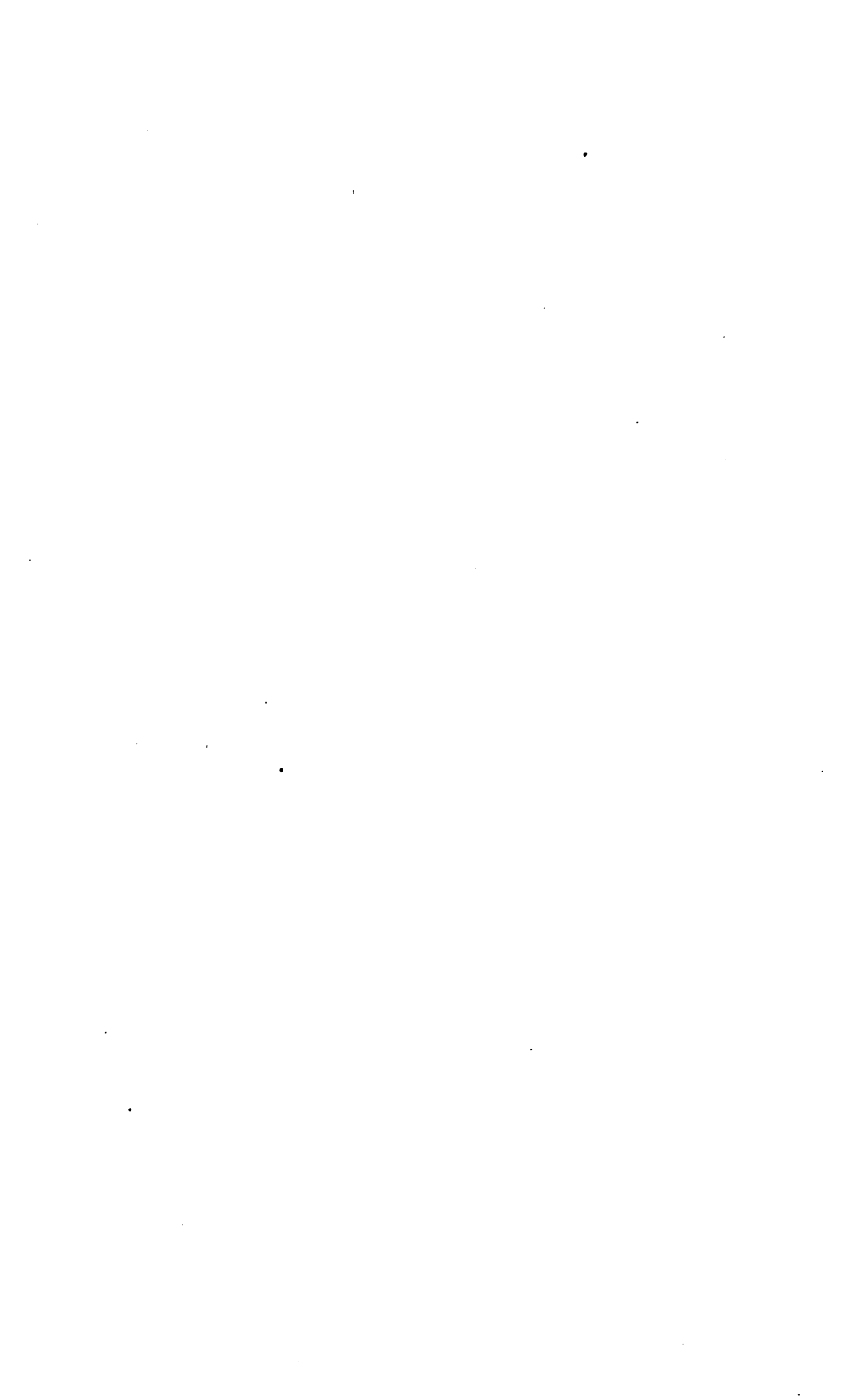
JOHN E. SANFORD.

JOHN I. BAKER.

CHARLES H. HOWLAND.

Boston, January 1, 1892.

APPENDIX.



APPENDIX.

[A.]

[See page 35 of this Report, *ante*.]

GROWTH OF THE FOREIGN STEAMSHIP COMMERCE OF THE PORT OF BOSTON.

By WILLIAM H. LINCOLN, OF BROOKLINE, MASS.

I should say that the development and increase of the foreign steamship business of the port of Boston began about the year 1875, when it was publicly announced that three steamers had been engaged to run regularly between this port and Liverpool. This was the beginning of what is now known as the Leyland line.

These steamers were the *Iberian*, *Istrian*, and *Illyrian*. For many years previously the Cunard line had maintained weekly sailings from this port for passengers and freight; but its steamers were of small capacity, and did not accommodate the growing business of the port. Many of our importers were obliged to ship their goods *via* New York; and, as an illustration of the greater competition and increase in business, it may be stated that the rates of freight from Liverpool are now about one-fifth of what was charged at that time.

The Warren line had also started in the business, but no regular sailings had been established. The Dominion line had also made this a winter port, and provided one sailing a fortnight. The first year of the Leyland line, the three steamers already mentioned afforded fortnightly sailings. The result was so satisfactory that three more steamers were added the following year, providing weekly sailings. There did not exist at that time any line of steamers to any other foreign port; and the sailings averaged about two steamers a week for Liverpool. That was the extent of our foreign steamship commerce.

It may be interesting to know that in this same year 1875, the first shipment of live cattle was made, by the steamer *San Marcos*, which took 150 head only. To show the development of this branch of the trade, it may be stated that during the five months ending November 30, 1891, there were shipped from this port 45,000 head of cattle. The shipment of fresh meat was also at that time unknown; whereas there were shipped from this port during the month of November last, over 5,000,000 pounds of fresh meat.

The shipment of cotton, which contributes now so largely to the cargoes of all our steamers for Liverpool, was then in its infancy, and the business had not developed in this port. In fact, there was no cotton brought here by rail for shipment to Europe, and the first efforts were made to bring cotton by the Baltimore steamship line from Norfolk. To show how this trade has increased, there were shipped from this port, during the month of November last, over 30,000 bales of cotton, and this will be largely increased the present month. The steamer *Lancastrian* of the Leyland line, which sailed last week, took over 5,000 bales, and this line had nearly 60,000 bales at one time under contract to transport.

In order to show more completely the enormous growth of our foreign steamship commerce, it will suffice to say that there are eighteen sailings to Liverpool alone the present month, eight sailings to London, four to Glasgow, and three to Hamburg and Antwerp. It will be noticed that this makes more than one sailing daily.

This alone does not indicate the enormous growth of our business, for it should be added that the steamers now employed are about double the capacity of those that were formerly engaged in the trade. For example, the first steamers of the Leyland line had a capacity of 2,500 tons weight, or 4,000 tons measurement. The present steamers carry 5,000 tons weight, or 8,000 tons measurement; so that not only have the number of sailings more than quadrupled, but the steamers have a capacity for more than twice the amount of cargo.

This vast increase can hardly be appreciated by those who are not familiar with the business. The enormous traffic constantly employs thousands of railway cars, and large docks have been constructed to accommodate the growing business.

The cargoes that these steamers bring from Europe are mostly consigned to our own merchants for distribution from this port. All our manufacturing industries have derived great benefit from this increase, and from the competition which has resulted in lower rates of freight.

The outward local business has also kept pace with the increased facilities, and the shipments of provisions, apples, leather, woodenware, organs, and other manufactured articles, indicate the growth and prosperity of this branch of the trade.

There seems to be no reason why this business should not grow in the future, though at present the ground seems to be fully occupied. One would not have dared to predict twenty years ago the vast increase that has since taken place.

Neither can we imagine the disastrous results that would follow any serious interruption of this business. It would be the height of folly for the city of Boston to sanction or allow any measures that would interfere with the foreign commerce of the port; for no one can comprehend the results that would ensue in all important branches of trade.

Rather should we seek to extend our facilities, and provide additional accommodations for a still larger commerce.

[B.]

[See page 38 of this Report, *ante*.]

ARTICLES OF AGREEMENT, MADE THIS SEVENTH DAY OF MAY, IN THE YEAR EIGHTEEN HUNDRED AND NINETY-ONE, BY AND BETWEEN THE COMMONWEALTH OF MASSACHUSETTS, ACTING BY ITS BOARD OF HARBOR AND LAND COMMISSIONERS, PARTY OF THE FIRST PART, AND WILLIAM MILLER, OF BOSTON, IN THE COUNTY OF SUFFOLK AND COMMONWEALTH AFORESAID, PARTY OF THE SECOND PART.

The said party of the second part hereby covenants and agrees with the said party of the first part, to do and complete all the work and other things specified and described in the following specifications for building a bulkhead on the South Boston Flats, in Boston harbor, all of the same to be done and completed in the manner, and in accordance with and subject to the terms and conditions, in said specifications set forth :—

Specifications.

Said party of the second part is to furnish all the plant, tools, appliances, labor and materials necessary to build 1,345 lineal feet of bulkhead on the South Boston Flats, located between the letters A-B and B-C on a plan on file in the office of the Board of Harbor and Land Commissioners, entitled "*Plan of Proposed Bulkhead on north side of 100-acre lot, South Boston Flats. April 20, 1891.*"

The style and manner of construction of the bulkhead are shown on the same plan on a scale of 2 feet=1 inch.

Said plan is made a part of these specifications, and is to be followed in all details shown thereon, though not specially mentioned herein.

The piles to be driven six feet apart on centres.

Three stringers of spruce timber, one 6" x 8", and the other two 6" x 10" each, to be bolted on the face of the piles.

The planking to be of 3-inch spruce plank, placed vertically,

driven at least two feet into the earth bottom, and well spiked to the stringers with $\frac{3}{4}$ -inch wrought iron ship spikes 7 inches long, and cut off level with the top of the highest stringer.

The planking to be still further secured by two battens of 3" x 6" spruce, bolted through to the two upper stringers every six feet, with extra bolts at the joints.

The bulkhead to be supported by fitting a 6" x 10" spruce stringer on the back of the piles of the new bulkhead $2\frac{1}{2}$ feet below their tops, and connecting this stringer through each pile by $1\frac{1}{4}$ -inch iron rods with a similar stringer placed behind the spurshore piles of the old bulkhead at the level of the flats, except for a distance of 150 feet as below; the whole to be fitted and constructed as shown in detail on said plan. In addition to the above, the stringers to be secured to the piles by $\frac{3}{4}$ -inch spike bolts not less than 15 inches long.

For a distance of about 150 feet between the letters D-E on said plan, instead of placing the stringer behind the spurshore piles of the old bulkhead, it is to be buried in the present filling at grade 8, on a line 18 feet south of and parallel with the line of the new bulkhead.

The piles to be of spruce, straight, sound and free from large knots, and not less than 10 inches in diameter at the butt when cut off, and not less than 6 inches in diameter at the point when ready for driving,—all measurements to be made under the bark,—and to be driven at least 12 feet into the hard clay; and all those injured in driving to be removed and replaced by perfect ones at the expense of the contractor.

The piles to be driven on a true line, so that the stringers may be put on full size without excessive cutting of the piles.

The piles to be cut off at grade 15, and the top stringer to be put on flush with the top of the piles, and the others as shown on plan, and bolted to the piles with 1" screw bolts.

The stringers to be in as long lengths as can be obtained, none less than 15 feet; joints to be spliced with pieces of the same not less than 3 feet long, and each splice fastened with four $\frac{3}{4}$ -inch screw bolts, all as shown on plan.

Angles in the bulkhead to be further strengthened by bolting stringers together where they meet, and by connecting the two piles nearest the angle by three $1\frac{1}{4}$ -inch screw bolts, as directed by the engineer.

The new work to be securely connected at the ends with the present bulkheads.

All planking and timber to be of spruce, sawed square, straight, sound, and free from large knots.

All iron work to be of best double refined wrought iron, satisfactory to the engineer.

In building the bulkhead in front of the lot leased to John Crowley, and in front of the lot and through the pier leased to Thomas Cargill, the work to be conducted so as to cause as little inconvenience to said Crowley and Cargill as is practicable.

At the intersection of the bulkhead with the trestle leading to the elevating station of the New England Dredging Company, such opening to be left through the upper portion of bulkhead as will, in the opinion of the engineer, allow free use of said trestle by said company, and the work to be conducted so as not to interfere with the use of said trestle.

In all questions which may arise concerning measurements, lines and grades, the decision of the engineer to be final.

All necessary aid and materials for giving or indicating lines and grades to be furnished by said party of the second part at his own expense; and convenient facilities for the inspection of the work to be furnished whenever requested.

All instructions and directions of the engineer to be strictly observed and followed.

All of the work to be done to the satisfaction of the engineer, and with such machinery and appliances, and by such methods, as shall be approved by him, and to the acceptance of said Board.

The work to be commenced at once, and to be prosecuted vigorously in all suitable weather until completion; and to be fully completed on or before the thirty-first day of July, 1891.

Upon the completion of the work, said party of the second part to remove all of his plant and appliances, and to leave the premises in a condition satisfactory to the engineer.

Estimates to be made by the engineer of the amount of work done up to the end of each calendar month, and payment to be made thereon of 90 per centum of the proportional part of the whole contract price applicable to such work, as computed by the engineer; and the remaining 10 per centum to be paid upon the final completion of the whole work.

If said party of the second part refuses or neglects to prosecute the work, or in any other respect fails to carry out the provisions of the contract, said Board may annul the same, and contract anew with other parties, without prejudice to its claim for damages arising from any breach thereof.

The word "engineer" as used herein means the engineer of said Board of Harbor and Land Commissioners, or his authorized assistant in immediate charge of the work.

The word "grade" means the grade above mean low water in

Boston harbor, as fixed and used by the engineer in the work of improvement on the South Boston Flats.

And said party of the first part, in consideration of the performance and completion of said work in the manner and in accordance with the terms and conditions aforesaid, hereby covenants and agrees to pay said party of the second part the sum of five thousand four hundred and eighty-nine dollars (\$5,489) ; the same to be in full compensation for all the work and other things done, furnished, performed and completed as aforesaid, and to be paid at the times, and in the manner, and upon the terms and conditions, set forth in the foregoing specifications.

IN WITNESS WHEREOF, on the day and year first above written, the said Commonwealth of Massachusetts, acting by its said Board of Harbor and Land Commissioners, has caused these presents to be signed and delivered in its name and behalf, and the seal of the Commonwealth to be hereunto affixed, and has also caused these presents to be approved by its Governor and Council ; and the said William Miller has hereunto set his hand and seal.

THE COMMONWEALTH OF MASSACHUSETTS,

By JOHN E. SANFORD, } *Harbor and Land*
CHAS. H. HOWLAND, } *Commissioners.*

WM. MILLER.

[SEAL]

Witness, FRANK W. HODGDON to W. M.

In Council, May 13, 1891. Approved.

Witness the Seal of the Commonwealth.

[SEAL OF THE
COMMONWEALTH.]

WM. M. OLIN, *Secretary.*

[C.]

[See page 38 of this Report, *ante*.]

ARTICLES OF AGREEMENT, MADE THIS SIXTEENTH DAY OF APRIL, IN THE YEAR EIGHTEEN HUNDRED AND NINETY-ONE, BY AND BETWEEN THE COMMONWEALTH OF MASSACHUSETTS, ACTING BY ITS BOARD OF HARBOR AND LAND COMMISSIONERS, PARTY OF THE FIRST PART, AND GEORGE H. CAVANAGH, OF BOSTON, IN THE COUNTY OF SUFFOLK AND COMMONWEALTH AFORESAID, PARTY OF THE SECOND PART.

The said party of the second part hereby covenants and agrees with the said party of the first part, to furnish all the materials and to do and complete all the work specified and described in the following specifications for repairing a wooden bulkhead on South Boston Flats, all of said materials to be furnished and all of said work to be done and completed in the manner, and in accordance with and subject to the terms and conditions, in said specifications set forth:—

Specifications.

The said party of the second part is to furnish all the plant, tools, appliances, labor and materials necessary to repair 1,435½ lineal feet of bulkhead on the South Boston Flats, located between the letters A-B and B-C on a plan on file in the office of the Board of Harbor and Land Commissioners, entitled “Plan of the portion of South Boston Flats proposed to be filled, March, 1889. Scale 24’00,” and to put said bulkhead in as good condition as when first built.

All the work and materials, except as otherwise herein expressly provided, to conform to the “Specifications for building a Wooden Bulkhead on South Boston Flats,” dated April 1, 1889, a copy* of which is hereto annexed, and which are referred to and made a part hereof.

* The specifications referred to are printed in the Report for 1889, Appendix F, page 63, and are here omitted.

About 100 new piles from 45 to 50 feet long will be required, and about 500 feet of the stringers and planking will require rebuilding.

The old material now in the bulkhead to be used only when it is uninjured and suitable in all respects, and new material to be furnished to complete the work.

Nearly all of the spurshores in the 1,435½ feet will require to be refitted or replaced with new ones. Where the heads of the spurshores are split, but otherwise in good condition, the split portions to be bolted together with two $\frac{3}{4}$ " screw bolts, one above and one below the main spurshore bolt.

In addition to the work above described, the bulkhead to be strengthened by cutting the heads of the upper spurshores level, trimming their sides square at the top, and fitting on top of them a 6"x10" spruce stringer, notched down 2" on the tops of the spurshores, fitted into notches in the main piles, and bolted into each main pile by one 1½" screw bolt, all as shown in red on a plan of said bulkhead forming a part of said specifications of April 1, 1889. The stringers to be in as long lengths as possible, and to be spliced in the same manner as the other stringers.

The statements herein made as to the amount of work and material required to repair said 1,435½ feet of bulkhead, are believed to be correct; but the party of the second part must examine for himself, as no allowance will be made for any inaccuracies which may be found therein, or for any additional work or materials which may be found necessary in the due execution of the contract, or for any further loss or damage which may occur before the completion of the work.

In all questions which may arise concerning measurements, lines and grades, or the use of old materials, the decision of the engineer of said Board to be final.

All necessary aid and materials for giving or indicating lines and grades to be furnished by the party of the second part at his own expense; and convenient facilities for the inspection of the work to be furnished whenever requested.

All instructions and directions of said engineer to be strictly observed and followed.

All of the work to be done to the satisfaction of said engineer, and with such machinery and appliances, and by such methods, as shall be approved by him, and to the acceptance of said Board.

The work to be commenced at once, and to be prosecuted vigorously in all suitable weather until completion; and to be fully completed on or before the thirty-first day of July, 1891.

Estimates to be made by said engineer of the amount of work

done up to the end of each calendar month, and payment to be made thereon of 90 per centum of the proportional part of the whole contract price applicable to such work, as computed by said engineer; and the remaining 10 per centum to be paid upon the final completion and acceptance of the whole work.

If the party of the second part refuses or neglects to prosecute the work, or in any other respect fails to carry out the provisions of the contract, said Board may annul the same, and contract anew with other parties, without prejudice to its claim for damages arising from any breach thereof.

engineer" as used herein means the engineer of said Board of Harbor and Land Commissioners, or his authorized assistant in immediate charge of the work.

And the said party of the first part, in consideration of the performance and completion of all of said work in the manner and in accordance with the terms and conditions aforesaid, hereby covenants and agrees to pay said party of the second part the sum of thirty-three hundred (3,300) dollars, the same to be in full compensation for all the work and other things done, furnished, performed and completed as aforesaid, and to be paid at the times, and in the manner, and upon the terms and conditions, set forth in the foregoing specifications.

IN WITNESS WHEREOF, on the day and year first above written, the said Commonwealth of Massachusetts, acting by its said Board of Harbor and Land Commissioners, has caused these presents to be signed and delivered in its name and behalf, and the seal of the Commonwealth to be hereunto affixed, and has also caused these presents to be approved by its Governor and Council; and the said George H. Cavanagh has hereunto set his hand and seal.

THE COMMONWEALTH OF MASSACHUSETTS,

By JOHN E. SANFORD, } *Harbor and Land*
CHAS. H. HOWLAND, } *Commissioners.*

GEO. H. CAVANAGH.

[SEAL.]

In Council, May 6, 1891. Approved.

Witness the Seal of the Commonwealth.

[SEAL OF THE
COMMONWEALTH.]

WM. M. OLIN, *Secretary.*

[D.]

[See page 39 of this Report, *ante*.]

ARTICLES OF AGREEMENT, MADE THIS TWENTY-FIFTH DAY OF JUNE, IN THE YEAR EIGHTEEN HUNDRED AND NINETY-ONE, BY AND BETWEEN THE COMMONWEALTH OF MASSACHUSETTS, ACTING BY ITS BOARD OF HARBOR AND LAND COMMISSIONERS, PARTY OF THE FIRST PART, AND THE NEW ENGLAND DREDGING COMPANY, A CORPORATION DULY ESTABLISHED UNDER THE LAWS OF SAID COMMONWEALTH, PARTY OF THE SECOND PART.

The said party of the second part hereby covenants and agrees with the said party of the first part, to do and complete all the work specified and described in the following specifications for filling a portion of the South Boston Flats, all of said work to be done and completed in the manner, and in accordance with and subject to the terms and conditions, in said specifications set forth: —

Specifications.

The party of the second part is to furnish all the plant, tools, appliances, labor and materials necessary for filling, as hereinafter specified, a strip about 1,000 feet long and 30 feet wide along the rear of the sea-wall on the northerly side of the reserved channel on the South Boston Flats.

The exact length along the line of the sea-wall to be determined by the engineer as the work proceeds.

The width of 30 feet to be measured from the rear line of the sea-wall on grade 13.

The dredged filling material to be allowed to take its natural slope, not exceeding *five to one*, beyond the 30-foot line.

After the dredged material has been deposited, a trench 3 feet wide to be excavated immediately in rear of the sea-wall down to the stone back ballast already in place, and to be refilled with fine chip stone ballast.

The dredged material, including that excavated from the trench, and the stone ballast in the trench to be left level at grade 13.

The dredged material for filling to be obtained by dredging from

the reserved channel west of Harrison Loring's wharf, at such place or places as may be designated by the engineer, and to a uniform depth of 12 feet below mean low water.

Special care to be taken not to disturb the sea-wall in any way; and if any stones are displaced, they are to be reset by the party of the second part at its own expense.

In all questions which may arise concerning measurements, lines and grades, the decision of the engineer to be final.

All necessary aid and materials for giving or indicating lines and grades to be furnished by the party of the second part at its own expense; and convenient facilities for the inspection of the work to be furnished whenever requested.

All instructions and directions of the engineer to be strictly observed and followed.

All of the work to be done to the satisfaction of the engineer, and with such machinery and appliances, and by such methods, and in such order, as shall be approved by him, and to the acceptance of said Board.

Upon the expiration of the contract, the party of the second part to remove all of its plant and appliances, and to leave the premises in a condition satisfactory to the engineer.

The work to be commenced at once, and to be prosecuted vigorously in all suitable weather until completion; and to be fully completed on or before the thirty-first day of August, 1891.

Estimates to be made by the engineer of the amount of work done up to the end of each calendar month, and payment to be made thereon of 75 per centum of the proportional part of the whole contract price applicable to such work, as computed by the engineer; and the remaining 25 per centum to be paid upon the final completion and acceptance of the whole work.

If the party of the second part refuses or neglects to prosecute the work, or in any other respect fails to carry out the provisions of the contract, said Board may annul the same, and contract anew with other parties without prejudice to its claim for damages arising from any breach thereof.

The word "engineer" as used herein means the engineer of the Board of Harbor and Land Commissioners, or his authorized assistant in immediate charge of the work.

The words "party of the second part" mean the corporation contracting to do the work, or its agent in immediate charge of the work.

The words "grade 13" mean the horizontal plane 13 feet above mean low water in Boston harbor, as fixed and used by the engineer in the work of improvement on the South Boston Flats.

And the said party of the first part, in consideration of the performance and completion of all of said work in the manner and in accordance with the terms and conditions aforesaid, hereby covenants and agrees to pay the said party of the second part the sum of thirty-nine and one-half ($39\frac{1}{2}$) cents per cubic yard of dredged and ballast material measured in the fill, after such material has been deposited and levelled as hereinbefore described; said sum to be in full therefor, and to be paid at the times, and in the manner, and upon the terms and conditions, set forth in the foregoing specifications.

IN WITNESS WHEREOF, on the day and year first above written, the said Commonwealth of Massachusetts, acting by its said Board of Harbor and Land Commissioners, has caused these presents to be signed and delivered in its name and behalf, and the seal of the Commonwealth to be hereunto affixed, and has also caused these presents to be approved by its Governor and Council; and the said New England Dredging Company, by Charles H. Souther, its president and treasurer, thereunto duly authorized, has caused these presents to be signed and delivered in its name and behalf, and its corporate seal to be hereunto affixed.

THE COMMONWEALTH OF MASSACHUSETTS,

By JOHN E. SANFORD, } *Harbor and Land*
CHAS. H. HOWLAND, } *Commissioners.*

NEW ENGLAND DREDGING COMPANY,

By CHARLES H. SOUTHER, [SEAL OF THE NEW ENGLAND
DREDGING CO.]
President and Treasurer.

In Council, July 1, 1891. Approved.

Witness the Seal of the Commonwealth.

[SEAL OF THE
COMMONWEALTH.]

WM. M. OLIN, *Secretary.*

[E.]

[See page 41 of this Report, *ante*.]

ARTICLES OF AGREEMENT, MADE THIS TWENTY-EIGHTH DAY OF MAY, IN THE YEAR EIGHTEEN HUNDRED AND NINETY-ONE, BY AND BETWEEN THE COMMONWEALTH OF MASSACHUSETTS, ACTING BY ITS BOARD OF HARBOR AND LAND COMMISSIONERS, PARTY OF THE FIRST PART, AND GEORGE H. KEYES, OF BOSTON, IN SAID COMMONWEALTH, PARTY OF THE SECOND PART.

The said party of the second part hereby covenants and agrees with the said party of the first part, to do and complete all the work specified and described in the following specifications for filling with gravel a portion of Congress Street on the South Boston Flats, all of said work to be done and completed in the manner, and in accordance with and subject to the terms and conditions, in said specifications set forth:—

Specifications.

Said party of the second part is to furnish all the plant, tools, appliances, labor and materials for filling with gravel, as herein-after specified, Congress Street from C Street easterly to the seawall on the northerly side of the Reserved Channel, on the South Boston Flats, reference being had for the location thereof to a plan on file in the office of the Board of Harbor and Land Commissioners.

The length of street to be filled is about 2,000 feet.

The depth of the gravel filling to be about 3 feet.

The top surface of the street, after the work is completed, to be left smooth and level at grade 16, and 75 feet wide measured at said grade.

The slope of the filling on the sides of the street to be *one and one-half* horizontal to *one* vertical.

The material used for filling to be clean, coarse gravel, free from rocks, large stones or bowlders, clay, loam and vegetable matter, and satisfactory in all respects to the engineer of said Board; and to be deposited, levelled and trimmed in accordance with the lines, grades and directions given by said engineer.

The amount of gravel required is estimated at about 18,000 cubic yards. The amount to be paid for to be ascertained by measurement in the fill after it has been deposited, levelled and trimmed as aforesaid, and no filling to be paid for which is more than 6 inches outside the prescribed lines, grades and slopes.

Said party of the second part to be responsible for all damages to persons or property arising from or in consequence of the work of filling, or from anything done by him in connection therewith. All injuries to sewers, man-holes, catch-basins and connections to be made good by said party of the second part.

The whole work to be completed on or before the thirty-first day of December, 1891.

In all questions which may arise concerning measurements, lines and grades, the decision of said engineer to be final.

All necessary aid and materials for giving or indicating lines and grades to be furnished by said party of the second part at his own expense; and convenient facilities for the inspection of the work to be furnished whenever requested.

All instructions and directions of said engineer to be strictly observed and followed.

All of the work to be done to the satisfaction of said engineer, and with such machinery and appliances, and by such methods, as shall be approved by him, and to the acceptance of said Board.

Estimates to be made by said engineer of the amount of work done and completed up to the end of each calendar month, and payment to be made thereon of ninety per centum of the contract price for such work, as computed by said engineer; and the remaining ten per centum to be paid upon the final completion and acceptance of the whole work.

If said party of the second part refuses or neglects to prosecute the work, or in any other respect fails to carry out the provisions of the contract, said Board may annul the same, and contract anew with other parties, without prejudice to its claim for damages arising from any breach thereof.

The word "engineer" as used herein means the engineer of said Board of Harbor and Land Commissioners, or his authorized assistant in immediate charge of the work.

The words "party of the second part" mean the person contracting to do the work, or his agent in immediate charge of the work.

The word "grade" means the grade above mean low water in Boston harbor, as fixed and used by said engineer in the work of improvement on the South Boston Flats.

And the said party of the first part, in consideration of the per-

formance and completion of all of said work in the manner and in accordance with the terms and conditions aforesaid, hereby covenants and agrees to pay the said party of the second part the sum of sixty-four (64) cents for each cubic yard of gravel filling, the same to be in full therefor, and to be paid at the times, and in the manner, and upon the terms and conditions, set forth in the foregoing specifications.

IN WITNESS WHEREOF, on the day and year first above written, the said Commonwealth of Massachusetts, acting by its said Board of Harbor and Land Commissioners, has caused these presents to be signed and delivered in its name and behalf, and the seal of the Commonwealth to be hereunto affixed, and has also caused these presents to be approved by its Governor and Council; and the said George H. Keyes has hereunto set his hand and seal.

THE COMMONWEALTH OF MASSACHUSETTS,

By JOHN E. SANFORD,	}	<i>Harbor and</i>
JOHN I. BAKER,		<i>Land</i>
CHAS. H. HOWLAND,		<i>Commissioners.</i>

GEORGE H. KEYES.

[SEAL.]

In Council, June 11, 1891. Approved.

Witness the Seal of the Commonwealth.

[SEAL OF THE
COMMONWEALTH.]

WILLIAM M. OLIN,

Secretary of the Commonwealth.

[F.]

[See page 41 of this Report, *ante*.]

AN INDENTURE BETWEEN THE COMMONWEALTH OF MASSACHUSETTS
AND THE CUNNINGHAM IRON WORKS COMPANY RELATING TO A
RAILROAD TRACK ACROSS B STREET ON THE SOUTH BOSTON
FLATS.

THIS INDENTURE, made this first day of December, in the year eighteen hundred and ninety-one, by and between the Commonwealth of Massachusetts, acting by its Board of Harbor and Land Commissioners, and the Cunningham Iron Works Company, a corporation established at Boston, in said Commonwealth, —

WITNESSETH, that said Commonwealth doth hereby authorize and license the said corporation to construct, maintain and use one railroad track, of standard gauge, across B Street (so called) on the flats or land of said Commonwealth situate in that part of Boston known as South Boston, the centre line of said track to begin on the easterly side line of said B Street at a point which is distant one hundred and forty-five and ninety-three one-hundredths (145.93) feet southerly from the southerly side line of Congress Street (so called), and thence to run westerly across said B Street curving southerly on the arc of a circle of about one hundred and sixty-seven (167) feet radius, — subject, however, to the following conditions and limitations : —

1. Said corporation shall build and maintain said track on a level with the finished grade of said B Street as the same now is or hereafter from time to time may be established by said Commonwealth or other lawful authority ; and shall at all times keep the rails so guarded and protected by plank, timber, paving or otherwise, as to secure a safe and easy passage across said track.

2. Said track may be operated by horse, steam or electric power ; but shall not, without the consent of said Commonwealth in writing first duly obtained, be used for any purpose except to convey materials and merchandise, manufactured and unmanufactured, in ordinary railroad freight cars, to and from the works

and premises of said corporation situate on the easterly side of said B Street between Congress and Fargo streets, as may be necessary or convenient in the regular course of the manufacturing business of said corporation there carried on; and no engine or car not in motion shall be allowed to stand on said track within the limits of said B Street.

3. If at any time hereafter, in the opinion of said Board of Harbor and Land Commissioners, the better security of the public requires that a flag be displayed, or that gates or bars be erected, at the crossing aforesaid, said corporation, upon notice in writing by said Board, shall cause a flag to be displayed, or shall erect and maintain gates or bars and cause the same to be closed, whenever an engine or car is about to cross and while crossing said street on said track.

4. Said corporation shall observe and follow the directions of said Board or its engineer in respect to the manner of executing and doing any of the work or other things herein authorized or required, and shall be subject to and shall comply with the provisions of any statute laws, now or hereafter in force, relating to railroads for private use, so far as they are applicable to the railroad track and crossing aforesaid.

5. All things herein authorized or required to be done by said corporation shall be done without cost or expense to the Commonwealth; and said corporation shall assume and pay all claims and demands arising in any manner from the construction, maintenance, use and operation of the track and structures aforesaid, and shall save harmless and indemnify the Commonwealth from all claims, suits, damages, cost and expense by reason thereof.

6. If at any time hereafter some other railroad track of standard gauge, and having a connection with a track of the New York & New England Railroad Company, its successors or assigns, is built for the permanent use of abutments in or along that portion of either of the streets on which the premises of said corporation abut as aforesaid, and if said corporation shall have or shall be given a right to connect with such other track by a branch or switch track running into its said premises, then the right of said corporation to maintain, use and operate the railroad track across B Street hereinbefore authorized, shall thereupon cease; and said corporation, within thirty days after notice in writing given by said Board, shall remove said last-named track and its appurtenances, and shall put the portion of the street where said track was in as good condition for travel as the adjacent portions thereof; and, in case of the failure of said corporation to comply with this condition, or with any other condition hereinbefore set

forth, the Commonwealth reserves and shall have the right by its agents to remove said track and put said street in order as aforesaid, and to recover the cost and expense thereof from said corporation.

IN WITNESS WHEREOF, on the day and year first above written, the Commonwealth of Massachusetts, acting by its said Board of Harbor and Land Commissioners, hath caused these presents to be signed and delivered in its name and behalf, and its seal to be hereunto affixed, and hath also caused these presents to be approved by its Governor and Council; and the said Cunningham Iron Works Company, by Thomas Cunningham, its treasurer, thereunto duly authorized, hath caused these presents to be signed and delivered in its name and behalf, and its corporate seal to be hereunto affixed.

THE COMMONWEALTH OF MASSACHUSETTS,

By JOHN E. SANFORD,	}	<i>Harbor and</i>
JOHN I. BAKER,		<i>Land</i>
CHAS. H. HOWLAND,		<i>Commissioners.</i>

CUNNINGHAM IRON WORKS COMPANY,

By THOS. CUNNINGHAM,

Treasurer.

[SEAL OF THE CUNNINGHAM
IRON WORKS CO.]

In Council, December 30, 1891. Approved.

[SEAL OF THE
COMMONWEALTH]

WM. M. OLIN,

Secretary of the Commonwealth.

[G.]

[See page 43 of this Report, *ante*.]

ESTABLISHMENT OF HARBOR LINES IN BOSTON HARBOR, AS RECOMMENDED BY THE HARBOR LINE BOARD AND APPROVED BY THE SECRETARY OF WAR, DURING THE YEAR 1891.*

I. CHARLES RIVER.

From Market Street Bridge to Watertown Dam — Pier and Bulkhead Lines.

On the South bank of the river, the line starts at the termination of the line approved by the Secretary of War March 17, 1890, on the north side of Market Street Bridge, and follows the north side of said bridge, easterly, to a point 20 feet west of the east abutment of said bridge; and thence to the Watertown Dam, in a curved line, which is indicated on the accompanying chart.†

On the North side of the river, the line starts at the termination of the line approved March 17, 1890, at the north corner of the west abutment of Market Street Bridge, and follows the face of the abutment to its south corner; and thence to the Watertown Dam, in a curved line, which is indicated on the accompanying chart.†

The lines thus described are pier and bulkhead lines, beyond which no structure shall hereafter be permitted.

[Approved by the Secretary of War, January 29, 1891.]

II. SOUTH BOSTON FLATS.

Pier and Bulkhead Lines.‡

Beginning at the point of intersection of the easterly line of E Street, in South Boston, with the southerly line of the Reserved

* The following explanations and descriptions of the several Harbor Lines as approved by the Secretary of War, are taken from the Reports of the Harbor Line Board recommending their adoption.

† A copy of this Chart is on file in the office of this Board.

‡ These lines are delineated on Sheet O of the Harbor Line Board, a copy of which is on file in the office of this Board.

Channel approved by the Secretary of War July 27, 1889, the *bulkhead* line follows said line of said street in a northerly direction 425 feet; thence runs north-easterly 323 feet to an intersection with a line parallel to and distant 700 feet from the southerly line of the Reserved Channel; thence along said parallel line to a point where it intersects a line drawn parallel to and 600 feet inside of the pier and bulkhead line on the north side of South Boston Flats, approved by the Secretary of War July 27, 1889, extended easterly towards Castle Island; thence northerly in a line normal to the curved portion of the exterior line of occupation of South Boston Flats to their intersection; thence westerly along said exterior line of occupation to a junction with the pier and bulkhead line before described and approved by the Secretary of War, at its termination at or near Slate Ledge.

The *pier-head* line on the north side of the Reserved Channel begins at a point in the easterly line of E Street, in South Boston, 400 feet northerly of the point of intersection of said street line with the southerly side of the Reserved Channel, and runs easterly by a straight line and a short curve of 200 feet radius to a point 300 feet distant and south of the bulkhead line above described, and continues parallel to said bulkhead line and 300 feet distant therefrom till it intersects the exterior line of occupation of South Boston Flats; thence westerly along said latter line to a junction with the bulkhead line.

The term *pier-head* is applied to lines beyond which no pile structure shall extend, and the term *bulkhead* to lines beyond which no solid filling shall hereafter be permitted.

[Approved by the Secretary of War, January 29, 1891.]

III. AROUND CASTLE ISLAND.

Pier and Bulkhead Line.

Beginning at a point in the line of the south side of the Reserved Channel, approved by the Secretary of War July 27, 1889, prolonged easterly, and 2,550 feet from the westerly line of Q Street, South Boston, the line continues easterly to the north-west corner of the north wharf on Castle Island; thence 60 feet following the outer face of said wharf; thence south-easterly 770 feet; thence southerly 830 feet; thence westerly 575 feet; thence south-westerly 900 feet; thence north-westerly 950 feet; thence north-easterly 500 feet; thence north-westerly 500 feet; thence westerly 200 feet; thence northerly 650 feet to the point of beginning, — as delineated on the accompanying chart, Sheet O.

[Approved by the Secretary of War, January 29, 1891.]

[H.]

[See page 46 of this Report, *ante*.]

AN AGREEMENT, MADE THIS THIRTIETH DAY OF MARCH, 1891, BY
AND BETWEEN THE COMMONWEALTH OF MASSACHUSETTS AND
GEORGE A. LANCASTER, OF BOSTON, IN SAID COMMONWEALTH.

The said Lancaster hereby agrees to break up the wrecked schooner (name unknown) now lying on the South Boston Flats northerly of Congress Street, and near the line of the prolongation of E Street, and to burn all the fragments thereof, or remove them to such place or places as shall be approved by the Board of Harbor and Land Commissioners; but no part or portion of said wreck shall be left below the level of high water.

The said Lancaster hereby assumes, and shall save said Commonwealth harmless from, all liability for damages to persons or property caused by, or arising in any way in, the execution of this contract.

The said work is to be completed on or before the thirtieth day of April, 1891; and, upon the completion thereof as above described, and to the acceptance of said Board, said Commonwealth agrees to pay to said Lancaster the sum of ninety-nine (99) dollars, the same to be in full compensation for all materials, apparatus, labor, services, cost and expense furnished or incurred therein.

IN WITNESS WHEREOF, on the day and year first above written, the said Commonwealth, acting by its said Board of Harbor and Land Commissioners, has caused these presents to be executed and delivered in its name and behalf, and the same to be approved by its Governor and Council; and the said George A. Lancaster has hereunto set his hand.

THE COMMONWEALTH OF MASSACHUSETTS,

BY JOHN E. SANFORD, } *Harbor and Land*
CHAS. H. HOWLAND, } *Commissioners.*

G. A. LANCASTER.

[SEAL.]

In Council, April 8, 1891. Approved.

WM. M. OLIN, *Secretary.*

[I.]

[See Page 46 of this Report, *ante*.]

AN AGREEMENT, MADE THIS FOURTH DAY OF JUNE, 1891, BY AND BETWEEN THE COMMONWEALTH OF MASSACHUSETTS AND GEORGE W. TOWNSEND, OF BOSTON, IN SAID COMMONWEALTH.

The said Townsend hereby agrees to remove the schooner "Aladdin," now lying sunken and abandoned in Fort Point Channel, in said city of Boston, together with the cargo and all the parts and appurtenances of said vessel, to some place approved by, and to the satisfaction and acceptance of, the Board of Harbor and Land Commissioners of said Commonwealth.

The said Townsend is to furnish at his own cost and expense all the plant, apparatus, materials, appliances and labor necessary for said work, and to save the Commonwealth harmless from all liability for damages to any person or property caused or arising in any way in or from the execution of this contract.

The said Townsend may dispose of the said vessel, her cargo and appurtenances, after removal as aforesaid, to his own use and benefit.

The work of removal is to be commenced at once, and completed within fourteen days from the date hereof.

Upon the completion of this contract as aforesaid, said Commonwealth agrees to pay said Townsend the sum of five hundred dollars (\$500), the same to be in full compensation for all things furnished and done, and for all cost and expense incurred, by him in the execution thereof.

IN WITNESS WHEREOF, on the day and year first above written, the said Commonwealth, acting by its said Board of Harbor and Land Commissioners, has caused these presents to be signed and delivered in its name and behalf, and the same to be approved by its Governor and Council; and the said George W. Townsend has hereunto set his hand.

THE COMMONWEALTH OF MASSACHUSETTS,

By JOHN E. SANFORD, } *Harbor and Land*
CHAS. H. HOWLAND, } *Commissioners.*

GEO. W. TOWNSEND.

[SEAL.]

In Council, June 11, 1891. Approved.

WM. M. OLIN, *Secretary.*

